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CONSTRUCTION • OPERATIONS • MAINTENANCE

PIPE LINE INDUSTRY

MARCH
1958

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SPECIAL REPORT

PROGRESS IN CORROSION CONTROL

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SMOOTH OPERATIONS

Record Tie-In Made Without a Hitch 61

For a "Quick Look" at this issue, turn the page . . .

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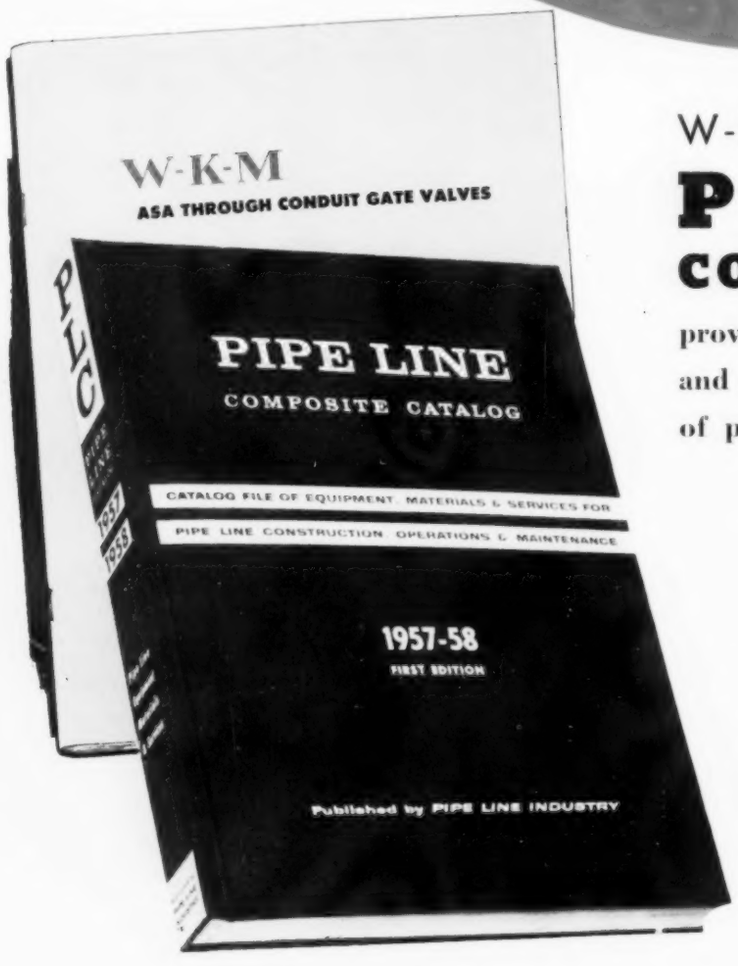
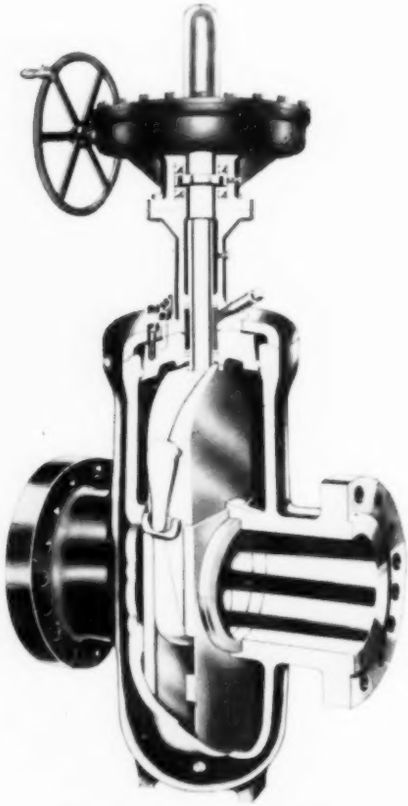
Selecting Pipeline Valves?



W-K-M 60-PAGE SECTION IN

PIPE LINE COMPOSITE CATALOG

provides quick, convenient data for selecting and specifying W-K-M Valves for every phase of pipeline operation.



W-K-M ASA THROUGH CONDUIT GATE VALVE

SEE PAGES 411 TO 470 OF PIPE LINE COMPOSITE CATALOG

for complete information on all W-K-M ASA Through-Conduit Parallel Expanding Gate Valves.

This 60-page section details design and operating features; gives size, pressure, dimensions, weights and end connections of every valve in the W-K-M line, body and trim materials, parts lists and ordering information. It also has ASA pressure-temperature ratings; ring-joint facing dimensions and details of butt-welding ends for valves.

This complete information in Pipe Line Composite Catalog simplifies selecting W-K-M Valves for mainlines, loops, gathering lines, compressor stations or wherever they are needed on the system.

When you want to know about W-K-M ASA Valves, refer to the Pipe Line Composite Catalog.

W-K-M

DIVISION OF acf INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS
MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

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PIPE LINE INDUSTRY

CONTENTS and Quick Look

March, 1958 Vol. 8, No. 3

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

Special Report on Corrosion Control Progress

Visual Evidence of Coating Theories

☐ Laboratory studies indicate internal coatings can increase efficiencies in gas transmission lines from 5 to 10 percent. Photomacrographs of coated samples demonstrate smoothness of coating surface. Effectiveness of in-place cleaning is also illustrated.

By John C. Watts.....Page 36

Design to Cut Cathodic Protection Costs

☐ Attention to some of these fundamentals of corrosion engineering will save money during installation of the cathodic protection system. Here are some operating tips that will save maintenance dollars, too.

By O. W. Everett.....Page 40

A Guide to Better Station Painting Programs

☐ An effective station painting program requires preconstruction planning, on-the-job inspection, and a follow-up maintenance program. Using these basic procedures with quality materials, long life can be expected from station painting.

By R. M. Ives, Jr.....Page 44

New Machine for Thin Film Coating

☐ Using a converted pipe line priming machine, a coal tar-epoxy coating is applied to 8,800 feet of pipe. After sandblasting, the pipe passed through the converted machine where a uniform 25 mil coating is applied. Blending and mixing of the coating is done with special metering equipment incorporated in the machine.

By N. T. Shideler.....Page 48

Coordinating Operations and Corrosion Control

☐ Proper communication between various departments of a company will go a long way toward making a corrosion control program successful. Both staff and operating groups can perform their jobs better if they understand each other.

By W. A. Hutchison.....Page 51

What Makes a Good Asphalt Coating?

☐ Often clouding the accurate evaluation of pipe line primers and enamels are the complex chemical analysis and physical properties of asphalts. Here are some worthwhile suggestions that will help provide a better understanding of performance tests.

By Lloyd F. Bramble.....Page 53

Aramco Looks at Its Coating Program

☐ Many factors other than cost should be considered in choosing a coating. In evaluating its coating program Aramco tried to determine the economic balance between cost of the coating system and the cost of installing and maintaining cathodic protection for all lines.

By V. M. Liss and Paul Fetko.....Page 56

How Sharp Is Your Income Tax IQ?

☐ A quick check of your understanding of tax situations often overlooked can mean money in your pocket. If you want to save tax losses, take time to read over this set of questions and answers before you file your return.....Page 60

Five Tie-ins Completed in One Day

☐ Service Pipe Line Company maintenance crews made detailed advance planning pay off during addition of new facilities on the line between Freeman, Mo., and Manhattan, Ill. Dispatching schedules, materials shipment and shop work laid out months in advance made the one-day tie-ins possible despite bad weather.

By Richard F. Gavitt.....Page 61

REGULAR MONTHLY DEPARTMENTS

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PIPE LINE INDUSTRY published every month. Entered as second class mail matter July 9, 1954, at the post office at Houston, Texas, under the act of March 3, 1879.

Memphis couldn't have known

IGNORANCE is no excuse.

Our parents made generous use of the paddle to teach us this time-worn lesson while we were still in knee pants. Then some of us grew up and forgot about it. Take the Memphis Decision, for instance:

United Gas Pipe Line Company has 600 customers. Out of that 600, it took just one city to throw the gas transmission industry into economic chaos. With an apparent complete lack of knowledge of basic business economics, the Memphis natural gas distributor and city government brought about a court decision against United Gas that, unless reversed by the Supreme Court, may create serious problems for the nation as a whole.

If the ruling holds, at least 34 pipe line companies may be required to refund some $225 million dollars they have received from recent rate increases—increases that were approved by the Federal Power Commission, but not by all the customers. Other repercussions:

- Pipe line companies will naturally find it harder to obtain price increases. Several hundred approvals will be needed, instead of one (Federal Power Commission) as before.
- With the lack of assurance that they can cope with rapidly rising costs of operation, transmission companies will be forced to set up short-term contracts with distributors.
- Without the guarantee of reasonable price increases and long-term contracts, it will become increasingly harder for transmission companies to obtain financing necessary for expansion and improvement of service. Some may even be forced out of business.

Until the above three factors have time to combine against them, distributors may have the edge at the bargaining table. But, as consumer needs keep expanding, the transmission companies will be forced to refuse to expand to meet those needs without adequate price increases—simply because they otherwise will not be able to afford it.

Without adequate transmission facilities, distributors' supplies will fail to keep pace with growing demand. People wanting natural gas won't be able to get it. In the long run, the consumer will be the loser.

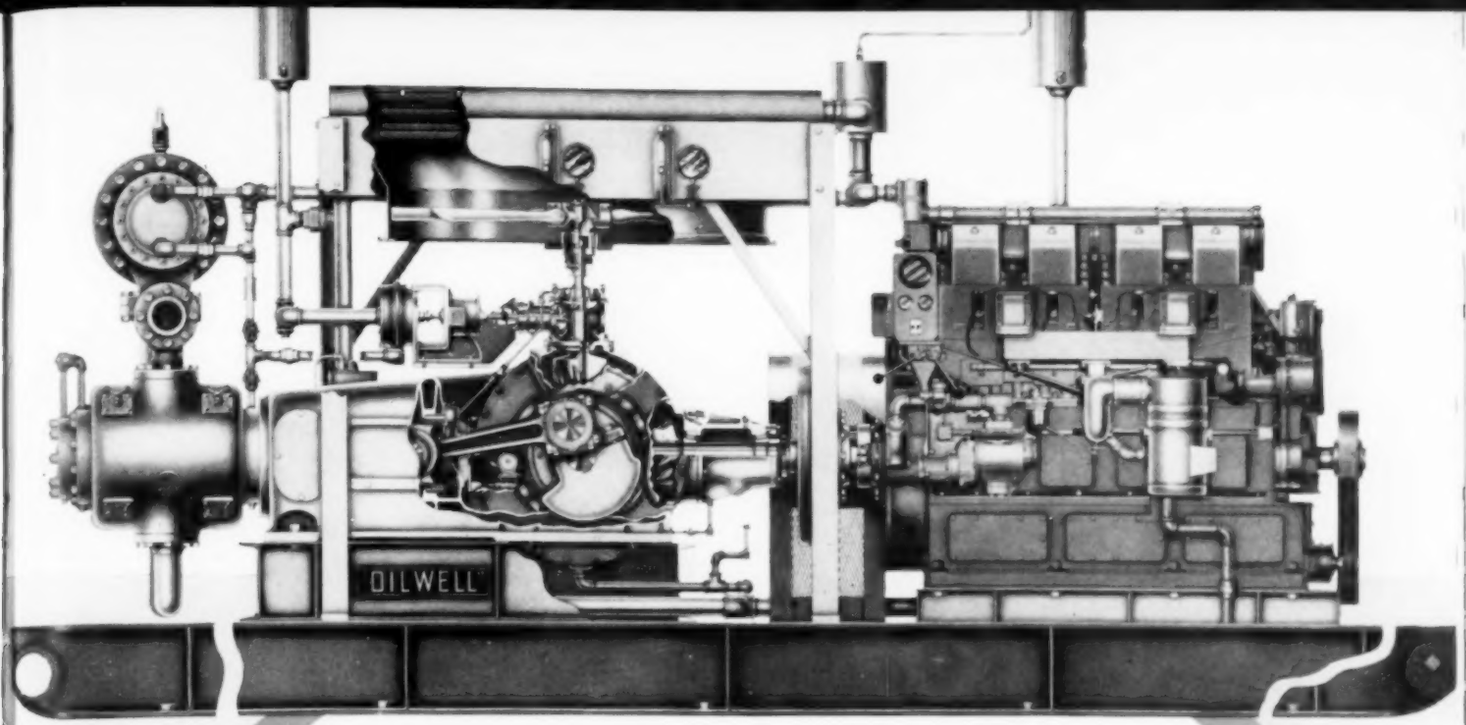
With this situation facing them it is hard to conceive why the Memphis groups took the United Gas case to court. The only possible explanation is that they did not know what the repercussions would be. However, ignorance is no excuse, even if a court decision upholds it.

If nothing else, the Memphis Decision has proved one thing: There will always be the possibility that another distributor will be completely misinformed about gas transmission economics. And, under the present ruling, all it takes is one customer out of hundreds to put a transmission company out of business—merely by refusing to accept a rate increase.

It all boils down to one tough nut that has to be cracked. No matter whether the Supreme Court reverses or upholds the lower court's decision against United Gas, the distributors and consumers must be better informed about the economics of natural gas transmission. They must be shown that, without any doubt, transmission companies are responsible companies—and will never increase prices without a good reason.

Several pipe line companies now have excellent distributor-relations programs, even to the extent of inviting top distributor management to go over every aspect of transmission operations. If *every* pipe line company will make it a point to keep its customers informed, no distributor will be able to say, "Nobody told me!"

Then, ignorance surely will be no excuse, simply because it won't exist.



Unusual and exclusive features make

"Oilwell" Direct-Connected Compressor Units

a better buy!

First: engine, duplex compressors and cooling system are all mounted on a single skid to assure perfect alignment.

Second: side-by-side compressors with a common crankshaft (an "Oilwell" exclusive) have direct mechanical drive through a right-angle gear box so that the unit requires minimum floor space.

Third: cooling systems are designed to provide adequate operating temperatures for both the engine and the compressors, and can be furnished horizontally or vertically.

Fourth: vital parts are enclosed. Positive lubrication is provided to compressor cylinders and piston rod packing by a mechanical forced-feed lubricator.

Fifth: slow-speed, horizontal-type compressors are designed with top suction and bottom discharge connections, especially for handling natural gas.

Sixth: no clutches.

Additional design features are incorporated into "Oilwell" DGE Gas Compressor Units to make them the outstanding line with 125, 175, 200, 250 and 300 hp ratings. An "Oilwell" engineer will gladly advise on the units most suitable for your requirements.

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WORLD OIL and THE COMPOSITE CATALOG for the drilling-producing industry.

PETROLEUM REFINER and THE REFINERY CATALOG for the refining-natural gasoline-petrochemical industry.

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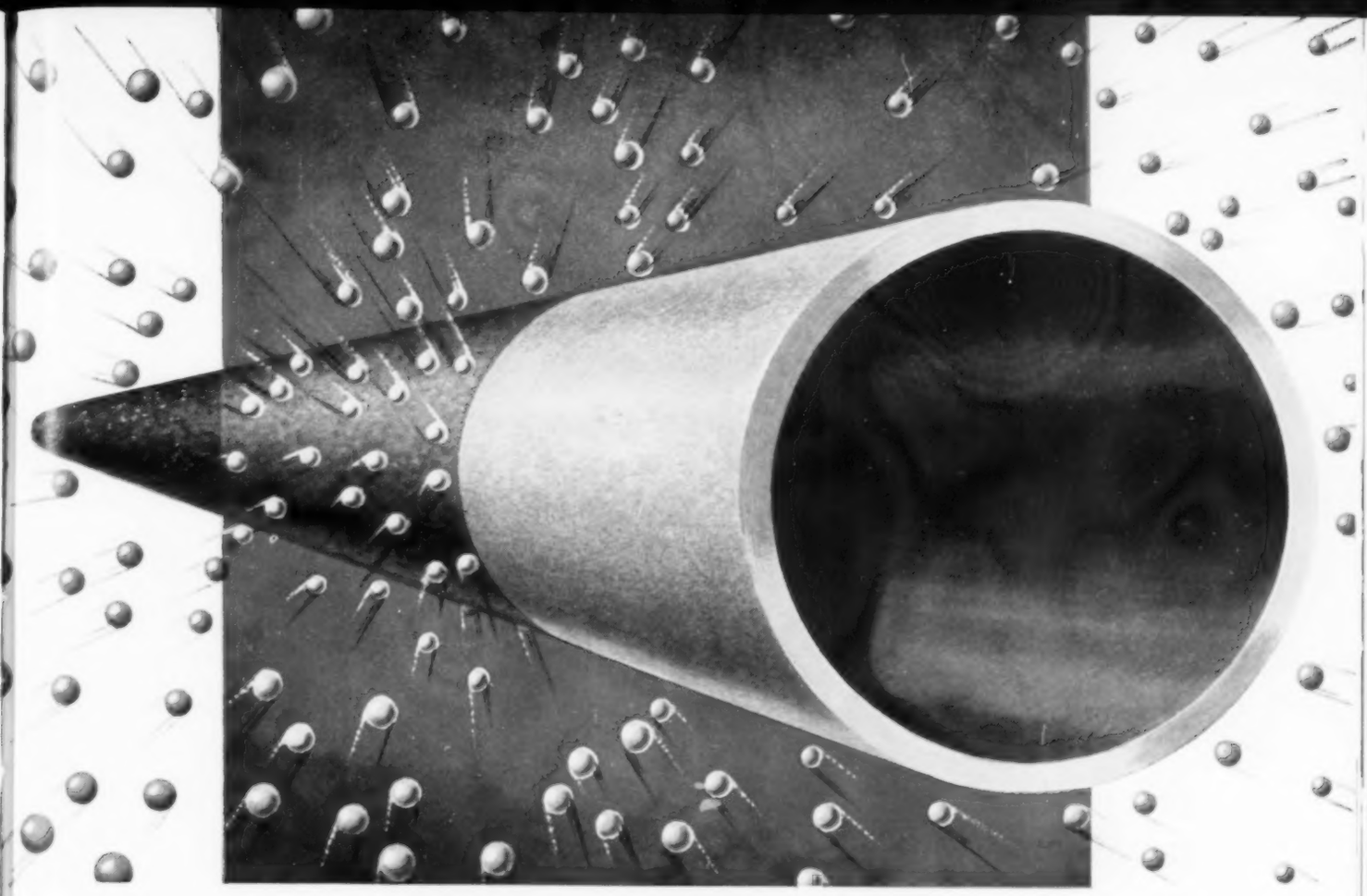


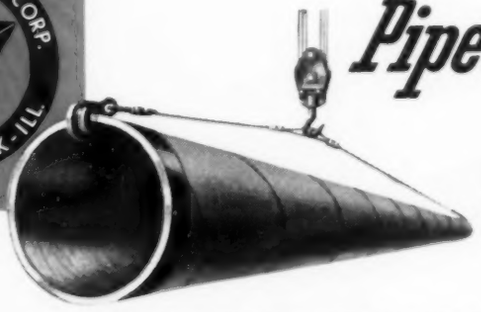
Steel Shot Cleaning makes Pipe Protection Stay Put

Applying protective coatings to improperly prepared pipe surface makes about as much sense as building a skyscraper on sand. Pipe Line Service has always pioneered in developing new ways to insure a good bond . . . a bond that makes protective coatings practically inseparable from the pipe itself.

An outstanding example is steel shot cleaning. Special machines permit bombardment of the pipe surface with millions of steel pellets traveling at high speed. Result? Not simply removal of mill scale and rust . . . but actually an "etching" of the steel surface. This slightly roughened surface allows the protective coating to "take root"—gives you the years of protection that you should have.

We emphasize Pipe Line's steel shot cleaning process because it was one of the great steps forward in maximum protection of *your* pipe investment. It's a manufacturing extra that's provided at no extra cost . . . and one more reason for extra confidence in specifying protection by PLS!

PIPE LINE SERVICE CORP. SERVICE EQUIPMENT MATERIALS FRANKLIN PARK - ILL.



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Quality pioneers in coating and wrapping pipe for over a quarter century

Plants also at: Monmouth Junction, N. J.; Glenwillard, Pa.; Sparrows Point, Md.; Longview, Tex.; Corpus Christi, Tex.; Provo, Utah; Harvey, La.

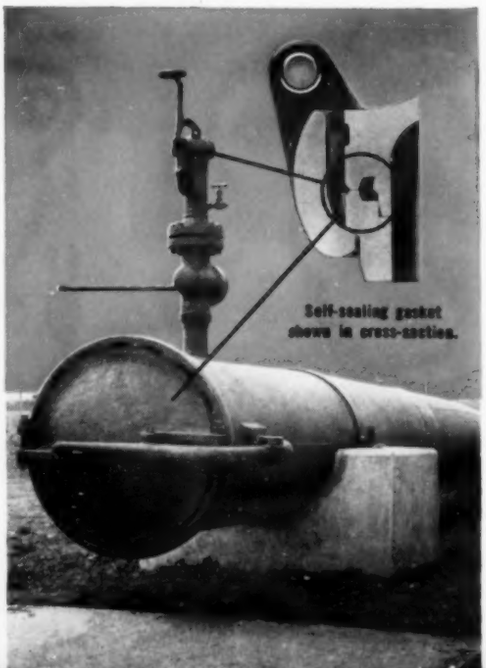
Sales offices at all plant locations . . . and Atlanta, Ga.; Houston, Tex.; Lincoln, Nebr.; Tulsa, Okla.

If you are a pipeliner

you'll appreciate this self-sealing gasket in UNIBOLT scraper trap and blowdown closures

Little things . . . like the gasket for a scraper trap or blowdown closure for example . . . can be a big headache. But not this one. It is the self-sealing gasket used in UNIBOLT pipeline couplings. The UNIBOLT design makes line pressure do the sealing. And this design practically encloses the gasket in steel so that when the closure is opened and closed the gasket is hardly disturbed. Made of oil- and gas-resistant Hycar nitrile rubber, this gasket will last indefinitely under normal conditions.

UNIBOLT scraper trap and blowdown closures are hinged for easy operation. Release only two bolts and the closure swings open and shut like a door. No heavy lifting. No time-consuming multi-bolt flanges. See our detailed data in Pipe Line Composite Catalog and write or wire for any needed information.



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C. E. Williams, Gulf Sales Engineer, Midland, Texas, and G. W. Ramsey, Assistant Plant Superintendent, inspect force feed lubricators on one of the modern gas engines at the Goldsmith plant of El Paso Natural Gas Company.

No lubrication problems in 8 years of operation

Since 1949, twenty-seven gas engine-compressor units developing 39,985 horsepower at the Goldsmith plant of El Paso Natural Gas Company have been thriving on Gulf Security Oil. Bearing, ring and cylinder wear maintenance records have been excellent.

Insure safe, more effective lubrication protection for *your* compressor units. Specify Gulf Security . . . the high quality, straight mineral oil. For full information, call your nearest Gulf office.

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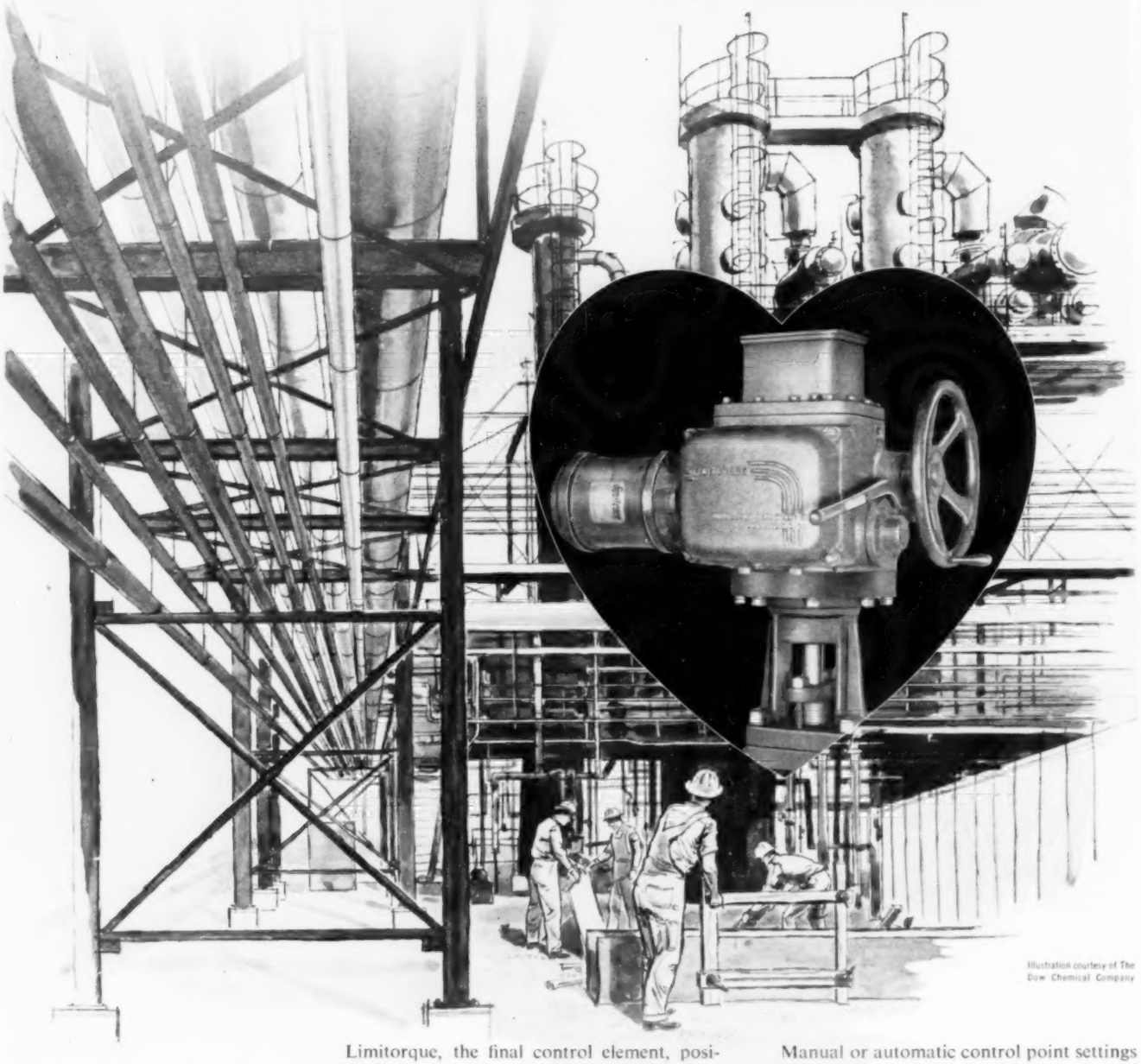

Illustration courtesy of The Dow Chemical Company

LimiTorque converts any variable into a constant...

Limitorque, the final control element, positively converts any up-stream process variable into a down-stream constant by continuously repositioning the control valve.

LimiTorque can be adapted to any control signal given by existing process control equipment and transducers.

Complete control systems are available from LimiTorque, and the components employed in the systems are chosen for dependability, with the elimination of complex circuits and special power supplies, and ease of maintenance.

Manual or automatic control point settings may be made in the control instruments of these systems and thus the required final control position is assured in proportional relationship to variations in the measured conditions.

The demand for centralization of performance responsibility in a single source, for complete process control system, is more than adequately met by these modern all electric actuator systems.

For more detailed information, write for Bulletin #6-57.

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Limitorque Corporation • Philadelphia

Tubing stretch mill, Youngstown, Ohio. Electronically controlled mill to be completed during second quarter of 1958 . . . will provide increased production for Tubing comparable to our increased capacity for Casing. Both Upset Finishing Mill and this facility will greatly augment our existing No. 1 and No. 2 Seamless Mills in Youngstown. Photo shows mill building under construction.

NEW MILLS FOR BIGGER MARKETS

Two years ago, ground was broken for our three new seamless Pipe facilities. The express purpose of this massive expansion program was to make YOUNGSTOWN'S production capacity and seamless pipe product mix conform to the future needs of the Oil and Gas Industries. These seamless pipe facilities are now integrated with your demands. This means you can look to YOUNGSTOWN for a full line of Oil Country Tubular Goods without limitations as to size, grade or finish in Drill Pipe, Casing, Tubing and Line Pipe!

QUALITY YOUNGSTOWN SERVICE

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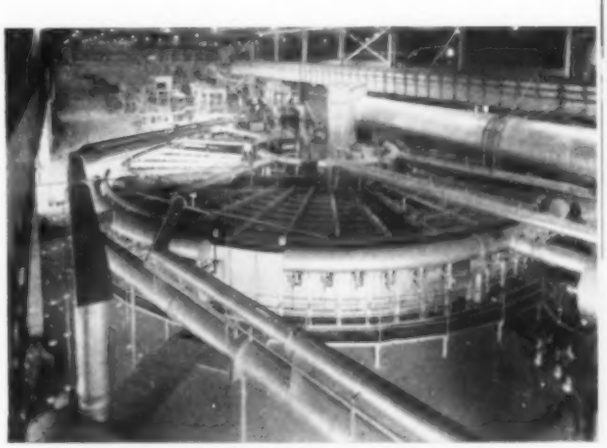
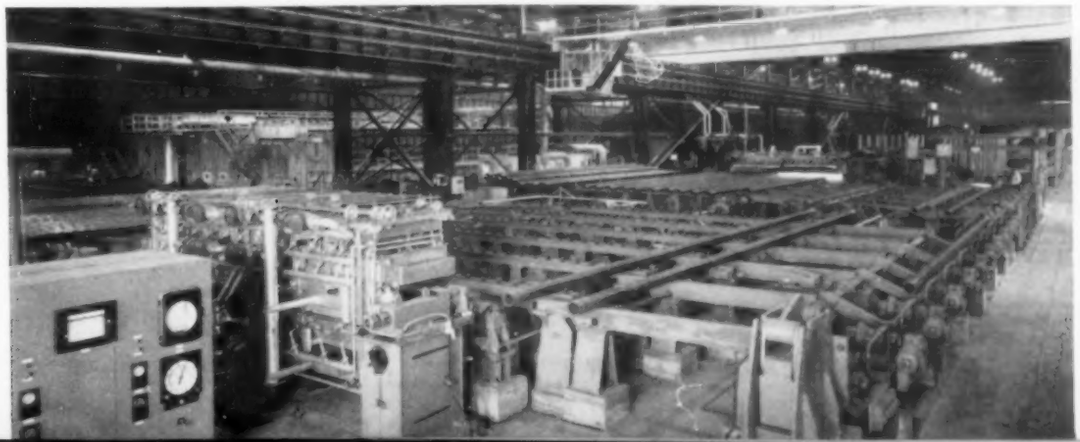
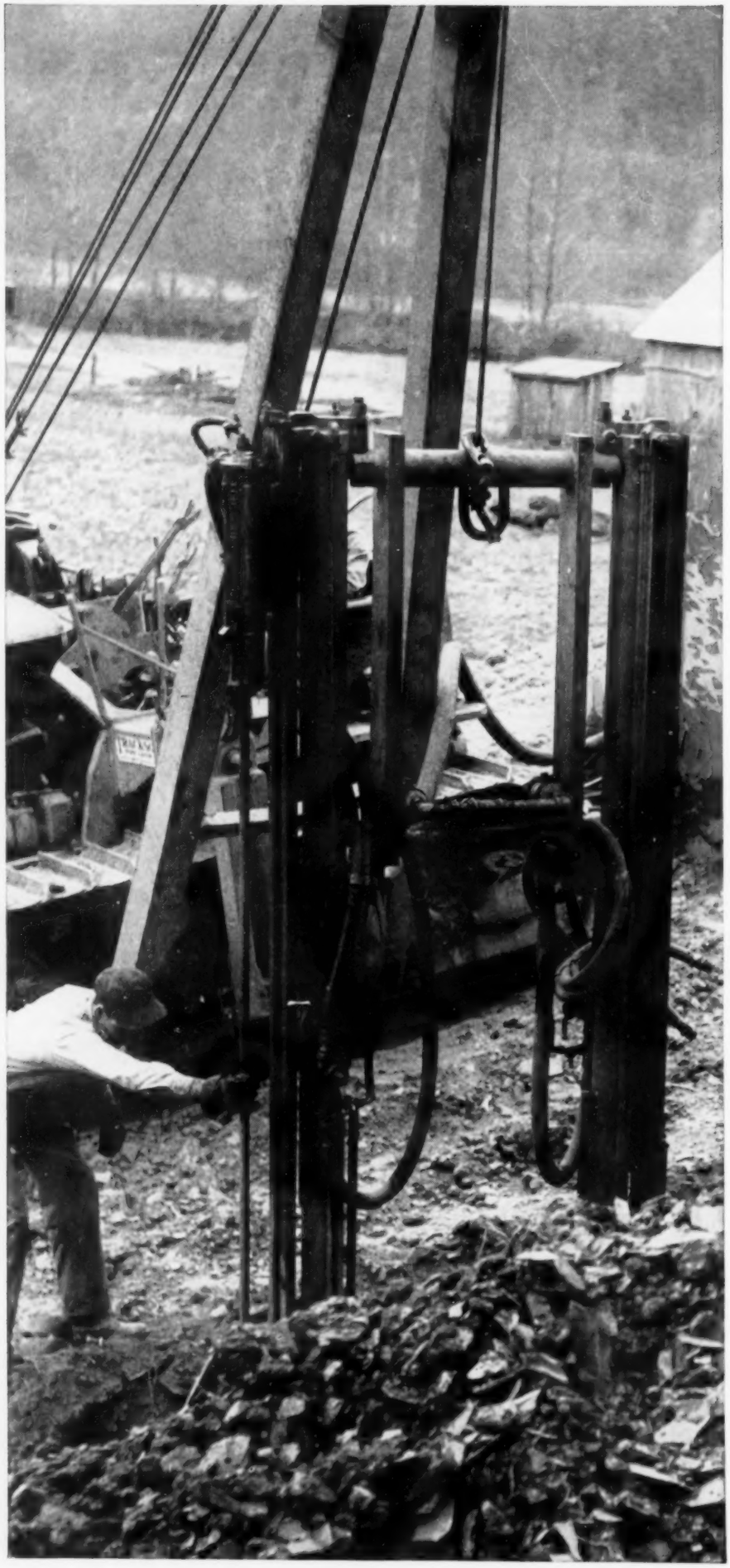


No. 3 seamless mill, Indiana Harbor, Indiana. Fully automated, ultra modern mill . . . began operating September 30. Contains world's largest Rotary Billet Heating Furnace . . . adds to our over-all capacity in both alloy and carbon casing. Offers API casing in sizes 4½", 5", 5½" and 7", in grades H-40, J-55, N-80, in ranges 2 and 3 . . . plus line pipe in sizes 4½", 5⁹⁄₁₆" and 6⅝" O.D. in grades A, B, X-42, A106, A53 in single and double random lengths. Photo shows Rotary Furnace in foreground.

Upset finishing mill, Youngstown, Ohio. Also a fully automated mill began operations September 15. Contains a pair of automatic upsetters with attendant furnaces plus a full-length normalizing furnace for highest quality control of all products. This mill adds to our capacity for Drill Pipe in grades D, E, x-95 and in Upset Casing (Speedtite). Photo shows upsetter and control panel in foreground, normalizing furnace in left rear.





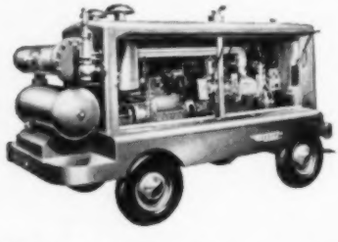
First fully efficient rotary compressor for pipeliners

Puts out full volume with same engine *running 150 rpm slower*

Other "600" rotary compressors produce 600 cfm of air at 100 psi when operating at 1750 or 1800 rpm. The more efficient Jaeger Roto Air-Plus, using the same economical GM Diesel Model 6-71 engine, delivers the same volume at only 1650 rpm.

This difference in efficiency means that, throughout the longer life of your Jaeger compressor, you will produce air with less fuel, fewer feet of engine piston travel and up to 150 fewer revolutions of compressor vanes every minute of every working day. What's more, you'll find engine and compressor so closely regulated that air pressure remains constant under all normal demands.

For full details, check with your Jaeger distributor or write us for Catalog JCR-5. Find out why the Jaeger "Roto" is the top performer for today's top pipeline contractors.



Model "600". Equally efficient performance is offered in "365" and smaller sizes.

The Jaeger Machine Company, 665 Dublin Avenue, Columbus 16, Ohio. Sales, Rentals, Service in over 150 Cities of U. S. and Canada

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ON TANK FARMS

AROUND PIPELINES

AT WELL SITES

stop weeds and fires before they start

get preventive weed control with

GEIGY

SIMAZINE* 50W

pre-emergence residual herbicide with

7 SAFETY FEATURES

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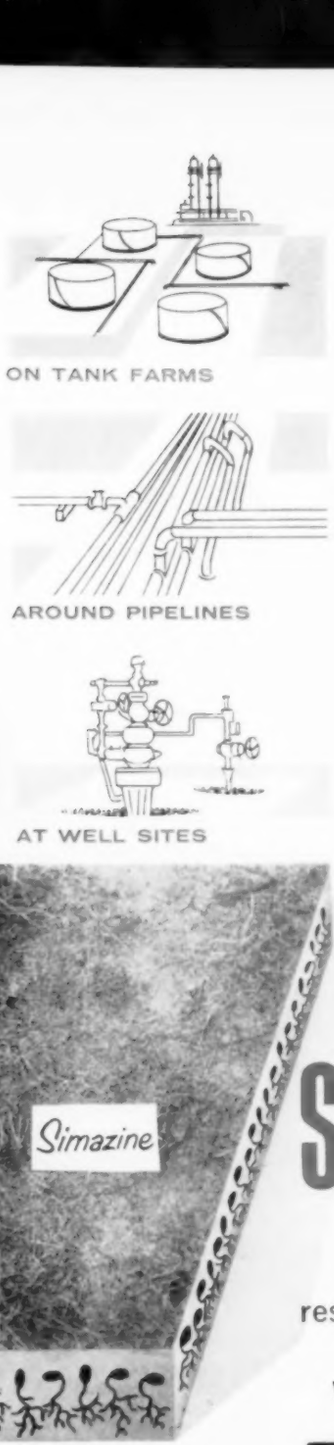
   Extremely low toxicity. No need for protective clothing.
2. **SAFETY TO ADJACENT VEGETATION**
   Minimum lateral leaching. Remains where it is applied.
3. **SAFETY TO SPRAYING EQUIPMENT**
   Non-corrosive or abrasive to equipment.
4. **SAFETY NEAR ELECTRICITY**
   Relatively low electrical conductivity.
5. **SAFETY FROM DRIFT HAZARD**
   Works through roots—little or no toxicity to foliage.
6. **SAFETY FROM FIRE HAZARD**
   Non-flammable. No application hazard.
7. **SAFETY ON VALUABLE LAND**
   Not a permanent soil sterilant.

ORIGINATORS OF Geigy DDT INSECTICIDES



Weed control is an old problem to the petroleum industry. Now Geigy's pre-emergence herbicide Simazine 50W provides a new and better solution – makes weed control *easier* because it is long residual; *safer* because of its Seven Safety Features; and *more effective* because it stops weeds before they start.

ONE APPLICATION PER SEASON

Simazine 50W reduces application costs in time, labor and material. At the rate of 10 lbs. per acre, one pre-emergence application controls annual grassy and broadleaf weeds for an entire season. At the rate of 20 lbs. per acre, one pre-emergence application controls most perennial weeds as well as annuals.

SEVEN SAFETY FEATURES

Oil maintenance men especially appreciate Simazine 50W's Seven Safety Features. This new herbicide is safe to humans and animals, non-flammable, non-corrosive, non-abrasive, and presents no conductivity problem or drift hazard. Check the panel for these and all of Simazine 50W's Seven Safety Features – and compare.

TECHNICAL SERVICE

Geigy Technical Service is readily available to serve you. Write for additional information, the name of your nearest Simazine 50W distributor, or ask to see a Geigy technical representative. Address: Geigy Agricultural Chemicals, P.O. Box, 430, Yonkers, N. Y.

* "SIMAZINE" is a trademark of Geigy Chemical Corporation

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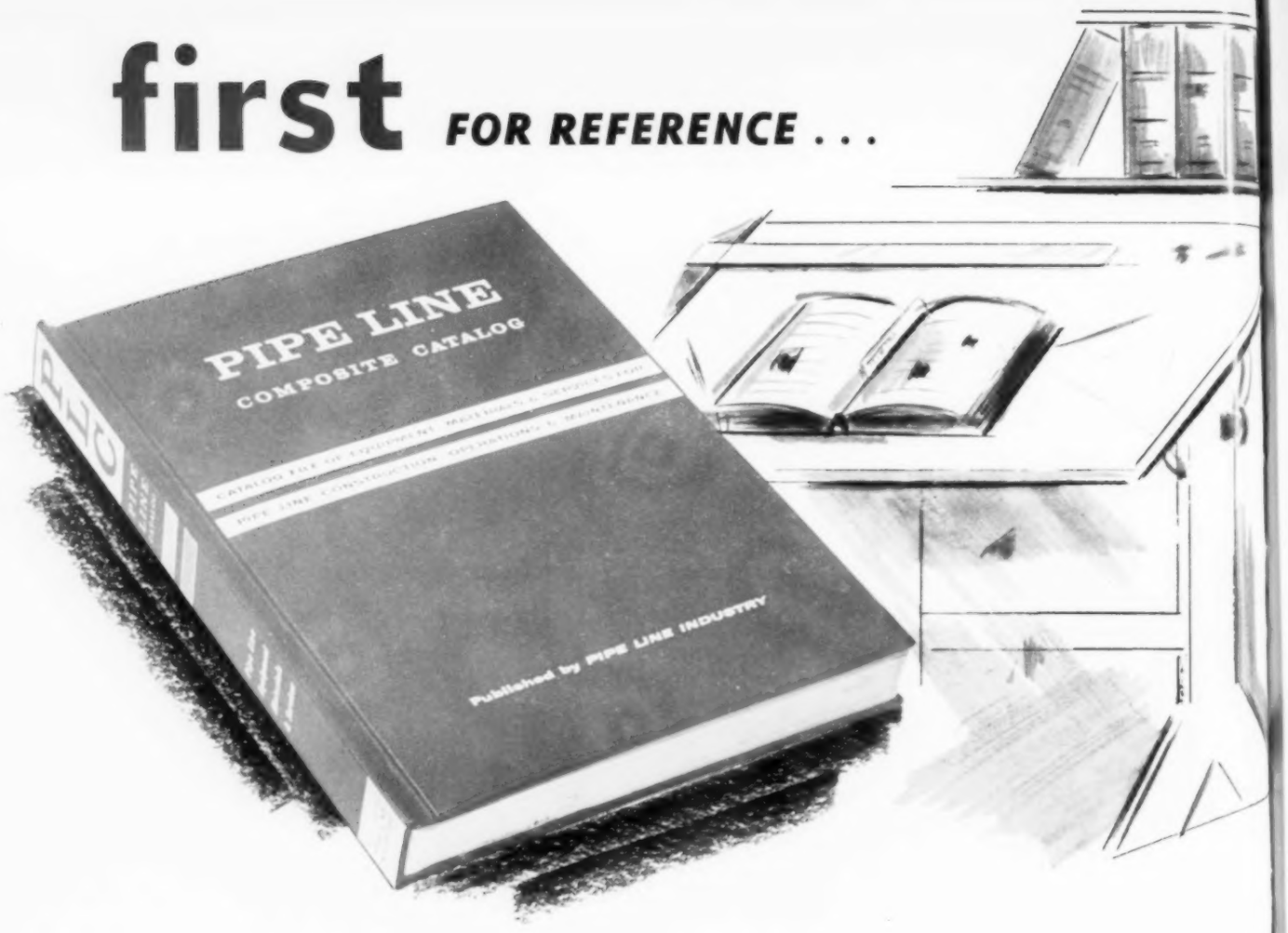

A one-volume reference library for purchasing and specifying. That's the best way to describe the only comprehensive catalog data file published specially for the Pipe Line Industry. Convenient to handle, thoroughly indexed, it is saving time and money for thousands of pipe line men.

first *FOR INFORMATION ON MANUFACTURERS AND SERVICE COMPANIES*

Included in 147 equipment and service company data in PLCC, there are 1,627 manufacturers' representatives and sources of supply listed.

first *FOR INDIVIDUAL EQUIPMENT AND SERVICE ITEMS*

There are 11,148 items of equipment and service items cataloged, with detailed information on specifications, installation, operation, maintenance, service—an entire library of useful reference.

first *FOR CONSTRUCTION EQUIPMENT AND SERVICE*

Pipe Line construction and service items listed in PIPE LINE COMPOSITE CATALOG total 390 . . . an invaluable aid to office and field specifications and purchases.

When you are ready to buy or specify, or if you just want planning information, look first in PIPE LINE COMPOSITE CATALOG.

ACF Industries, W-K-M Division
The Aerotec Corp.
M. N. Aitken Co.
Alco Products, Inc.
Aldrich Pump Co.
Allied Chemical & Dye Corp., Barrett Division
Allis-Chalmers
Alston Manufacturing Co.
American Blower Division of American-Standard
American Cyanamid Co., Jefferson Chemical Co. Subsidiary
Anchor-Wate
Automatic Power Inc.

Barber-Greene Co.
Barrett Division, Allied Chemical & Dye Corp.
J. B. Beaird Co., Inc.
Berry Hydraulics, Oliver Tyrone Corp.
Bethlehem Supply Co.
Bettis Corp.
Books for Pipe Line Industry
Borg-Warner Corp., Byron Jackson Div.
Bramble Industries, Gulf States Asphalt Co. Division
Bucyrus-Erie Co.
Buffalo-Eclipse Corp., Penberthy Manufacturing Co. Division
G. T. Bynum Co.
Byron Jackson Pumps, Inc., Subsidiary of Borg-Warner Corp.

E. L. Caldwell Co.
Philip Carey Mfg. Co.
Caterpillar Tractor Co.
Cathodic Protection Service
Central Plastics Co.
Clark Bros. Co., One of The Dresser Industries
Coffing Hoist Division, Duff-Norton Co.
Colorado Fuel and Iron Corp., Wickwire Rope Division
Commercial Iron Works
Cook Bros. Equipment Co.
C. Lee Cook Co., Division of Dover Corp.
Corrosion Rectifying Co., Inc.
G. A. Cotten Co.
M. J. Crose Manufacturing Co., Inc.
Crutcher-Rolfs-Cummings, Inc.

Darling Valve & Manufacturing Co.
John Deere—Industrial Division
Dover Corp., C. Lee Cook Co. Division
Dresser Industries, Clark Bros. Co. Division
Magnet Cove Barium Corp. Division
Drive-Thru Gate Co.
Duff-Norton Co., Coffing Hoist Division
Dutch Brand Division, Johns-Manville Corp.

Allan Edwards, Inc.
Elliott Co., Ridgway Division
Embart Manufacturing Co., The Maxim Silencer Co. Subsidiary
Engineering Research Corp.

Falk Corp.
Farrel-Birmingham Co., Inc.
Federal Telephone and Radio Co., Division of International Telephone and Telegraph Corp.
Fish Engineering Corp.
Flexitallic Gasket Co.
Fluor Products Co., Division of Fluor Corp., Ltd.

Gardner-Denver Co.
Gaso Pump & Burner Mfg. Co.
Gearench Mfg. Co.

These leading manufacturers, suppliers and service companies have filed complete or condensed catalog data in the current edition of the new PIPE LINE COMPOSITE CATALOG. See their detailed information in the catalog when you are ready to buy.

General Electric Co.
The Gorman-Rupp Co.
Granberg Corp.
Greenhead Sling and Supply Co.
Greenwood Valve Division, Vernon Tool Co., Ltd.
Grove Valve and Regulator Co.
The Gulf Publishing Co. (Pipe Line Forms)
Gulf States Asphalt Co., Division of Bramble Industries

H & L Tooth Co.
H & M Pipe Beveling Machine Co.
Hamer Valves Inc.
Hammond Iron Works
Haynes Manufacturing Co.
Hercules Motors Corp.
Holcombe Co., Inc.
Homelite, Division of Textron Inc.
Houston Equipment Co., Inc., Division of Houston Foundry & Machine Co.
Hudson Engineering Corp.
Humble Oil & Refining Co.
Hydril Co.

Ingersoll-Rand Co.
International Telephone and Telegraph Corp., Federal Telephone and Radio Co. Division

Jefferson Chemical Co., Subsidiary of American Cyanamid Co.
Johns-Manville Corp., Dutch Brand Div.

King Tool Co., Ltd.
Kinzbach Tool Co., Inc.

L & M Company
L-K Pump Valve Co.
Ledeen Mfg. Co.
LeRoi Division, Westinghouse Air Brake Co.
Lloyd Metal Foundry
Lubrikup Co., Inc.
Lufkin Foundry & Machine Co.

Magnet Cove Barium Corp., One of the Dresser Industries
Magnetrol Inc.
S. N. M. A. R. E. P.
Marsh Instrument Co.
Mason-Neilan Division of Worthington Corp.
C. A. Mathey Machine Works, Inc.
Mavor-Kelly Co.
Maxim Silencer Co., Subsidiary of Embart Manufacturing Co.
McFarland Engineering & Pump Co.
McFarland Manufacturing Corp.
McKissick Products Corp.
Mercoid Corp.
Midwestern Pipe Line Products Co.
Mine Safety Appliances Co.
Mixing Equipment Co., Inc.
Modern Motors Sales & Service
Morris-Young-Owens Co.
Mountain States Asphalt Co., Division of Bramble Industries

Multiple Corp.
Frank W. Murphy, Manufacturer, Inc.

National Cylinder Gas Co., Tube Turns Division
National Tank Co.
Naylor Pipe Co.
Nickles Machine Corp.

Oliver Tyrone Corp., Berry Hydraulics
Oil Well Supply Division, United States Steel Corp.

Panellit, Inc.
Peerless Manufacturing Co.
Pelican Supply Co., Inc.
Penberthy Manufacturing Co., Division of Buffalo-Eclipse Corp.
Perrault Equipment Co.
Petrolite Corp., Tretolite Co. Division
Pipe Line Development Co.
Pipelife Corp.
Pittsburgh-Des Moines Steel Co.
Plyon QX, Modern Motors Sales & Service
Porter Co.
Potter Aeronautical Corp.
Protecto Wrap Co.
Pye Telecommunications Ltd.

Quality Marsh Equipment Co., Inc.

Ramsey Winch Manufacturing Co.
Reilly Tar & Chemical Corp.
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Rochester Manufacturing Co., Inc.

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Taylor Instrument Companies
Textron Inc., Homelite Division
Thermix Corp.
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Tinker & Rasor
Tretolite Co., Division of Petrolite Corp.
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Tube Turns, Division of National Cylinder Gas Co.

United States Motors Corp.
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Vernon Tool Co., Ltd., Greenwood Valve Division
J. H. H. Voss Co., Inc.

W-K-M Division of ACF Industries, Inc.
E. H. Wachs Co.
John Waldron Corp.
Waukesha Motor Co.
Westinghouse Air Brake Co., LeRoi Division
Frank Wheatley Pump & Valve Mfr.
White Diesel Engine Division, The White Motor Co.
Whitmor Homebuilders, Inc.
Wickwire Rope Division, The Colorado Fuel and Iron Corp.
Wilkinson Products Co.
Worthington Corp.
Worthington Corp., Mason-Neilan Division

Yale Machine Works

PIPE LINE COMPOSITE CATALOG

Published by PIPE LINE INDUSTRY

P. O. BOX 2608 **HOUSTON, TEXAS**

Along the new highways . . .
ROSKOTE DOES THE JOB WITH SPEED!

Fast drying that permits overcoating or wrapping in a half hour steps up the protective coating phase of new pipeline construction on the jobs where speed is essential — along the nation's new network of highways.

A good example is this 8000 foot stretch of new 8" pipe along the new Southside Expressway in downtown Charleston, W. Va. It was installed recently for the United Fuel Gas Company by Saul and McCallister, Inc., of Yawkey, W. Va.

This contractor found that two men, using the Roskoter for application of Roskote 612 XM cold-applied pipe mastic, could keep pace nicely with the welders. The coating specifications called for over-the-ditch cleaning, two 15 mil applications of Roskote 30 minutes apart, followed immediately by wrapping with 15 lb. perforated asbestos pipeline felt.

Roskote 612XM is a cold-applied, fast-drying pipe mastic of high electrical resistivity. Composed of high grade native pyrobitumens homogenized with quality aromatic solvents and inhibitive pigments, Roskote is also highly resistant to corrosion by acid, alkali and salt. It dries to a tack-free film in 30 minutes or less. It is unaffected by temperature from sub-zero to 250° F. It will not oxidize, scale or check, and it bonds readily to previous coats of Roskote, coal tar or asphalt.

Non-toxic and non-irritant, Roskote may be applied by brush, glove, spray or Roskoter. The latter is seen in use in the photograph.

The Roskoter, one of the simplest means of coating pipe known, is also the most effective. It actually "bathes" the pipe in mastic as an extra safeguard against pinholes and other coating irregularities. And it gets the undersurface and other hard-to-see spots, often missed. Coating with the Roskoter can usually be handled by one man.

Roskote Cold-Applied Pipe Mastic enjoys the confidence of over 400 utilities and pipeline companies. For complete technical data and prices, write your nearest Royston office.

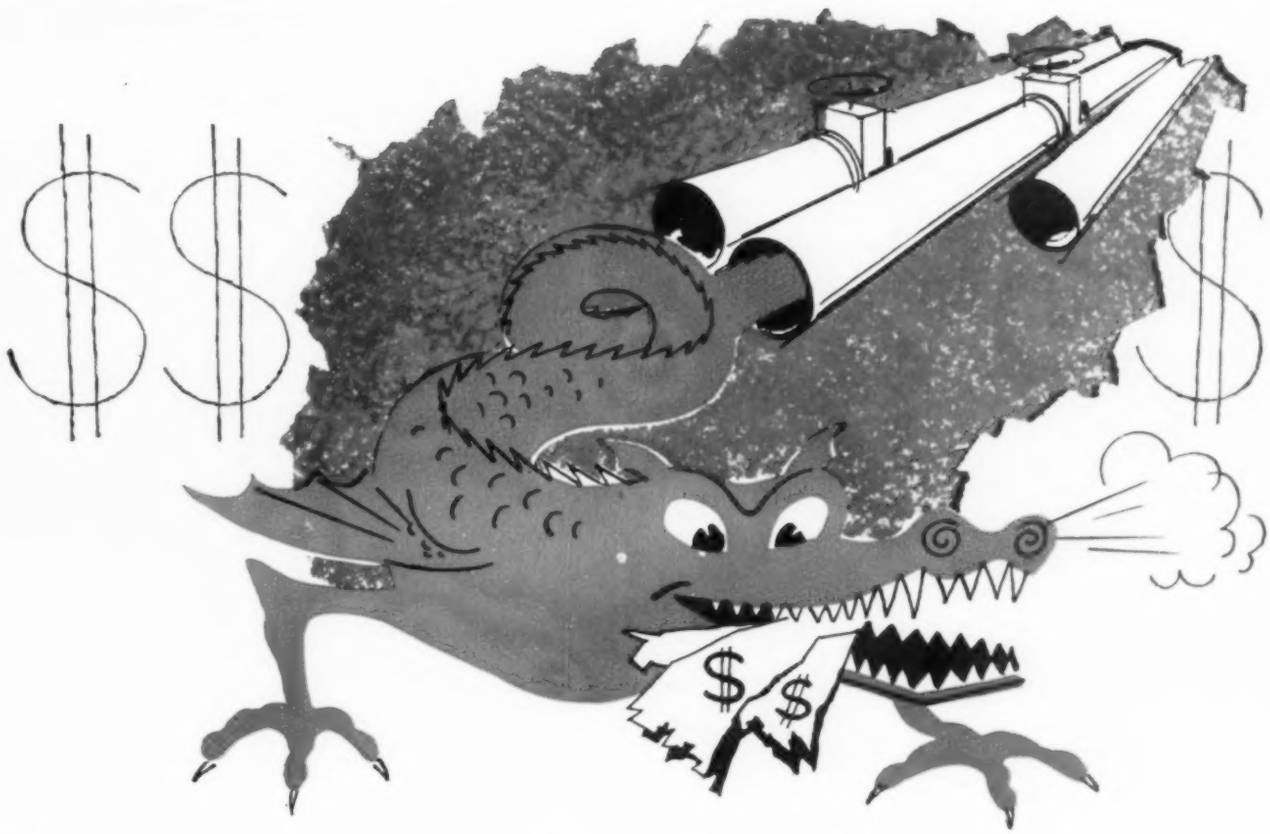
Royston Laboratories, Inc.
Box 112-D, Blawnox,
Pittsburgh 38, Pa.

ROSKOTE

BRANCH OFFICES IN ATLANTA, CHICAGO, HOUSTON, PHILADELPHIA, SAN DIEGO AND TULSA. WAREHOUSED IN NORTHEAST, SOUTHEAST, NORTH CENTRAL AND SOUTH CENTRAL REGIONS.

A LEADER IN THE FIELD OF INDUSTRIAL COATINGS FOR CORROSION CONTROL.

UNICOR® keeps corrosion from eating a big hole in your profits



Talk about money down the drain! Look at the ways corrosion can lose you money:

1. Reduced flow capacity means less volume handled per day. Corrosion in your pipeline takes up money-making space, reduces C factor and output.
2. Filters cost money. Take a look at your filter replacement cost sheet for the past year and you'll see what we mean.
3. Downtime for filter cleaning and replacement is a dead weight on overhead. You're not making money when you're not on stream.
4. Equipment replacements aren't cheap, either. When corrosion takes over tanks and pipelines, you're out-of-pocket for new ones.

And now look at the ways UNICOR saves your money and your equipment:

1. Unicor is a film-forming, oil-soluble inhibitor that prevents all types of pipeline corrosion. Tanks, vessels, pipelines are protected whether full, half-full or empty.
2. Unicor increases C factor to a maximum, reduces power costs, filter replacements and scraping operations.
3. Unicor costs about $0.001 (one-tenth of a cent!) per barrel of product. One molecule of Unicor to one million molecules of product gives effective anti-corrosive action.

Stop corrosion and fouling. Save money and improve product quality. Specify UNICOR for any internal pipeline corrosion problems. If you'd like to evaluate UNICOR before you send an order, write for information and samples.

UNICOR® One of the family of superior UOP additives and inhibitors available to the petroleum industry

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U.S.A.

More Than Forty Years Of Leadership In Petroleum Refining Technology

. . . here's why

CHECK THESE FACTS!

INTEGRITY OF MATERIALS

Farris metallurgy of parts offers as *standard*, stainless steel, rather than carbon steel in critical locations; and use of hardened parts for highest valve operating efficiency.

MINIMIZED SPARE PARTS INVENTORY

Since 1945 every new Farris part has been interchangeable with former parts, keeping inventories at minimum . . . with parts low priced!

NO OBSOLESCENCE OF DESIGN

Construction improvements — not repeated design changes — have resulted in user recognition, standardization of design; eliminating confusion and expense to the customer.

UNEQUALLED QUALITY AT COMPETITIVE PRICES

Freedom from changing inventory, new pattern problems and continuous new tooling permits lowest production costs, passed on to the user in lowest valve costs.

LICENSED TO OTHERS

In the Industry's interest, limited licensing arrangements were granted . . . A Farris patent number is your protection.

PROVEN SAFE PERFORMANCE

The complete dependability of Farris valves has been proven by 13 years of use in the field, under all service conditions.

Meets ASME-NB Requirements for ASME Unfired Pressure Vessel Code, Section 8 and ASME Power Boiler Code, Section 1.

Send for the NEW Farris Engineering Catalog. A complete, detailed listing of Farris Process Safety and Relief Valves, plus useful information to help you select the proper valve for your requirements.

Farris®

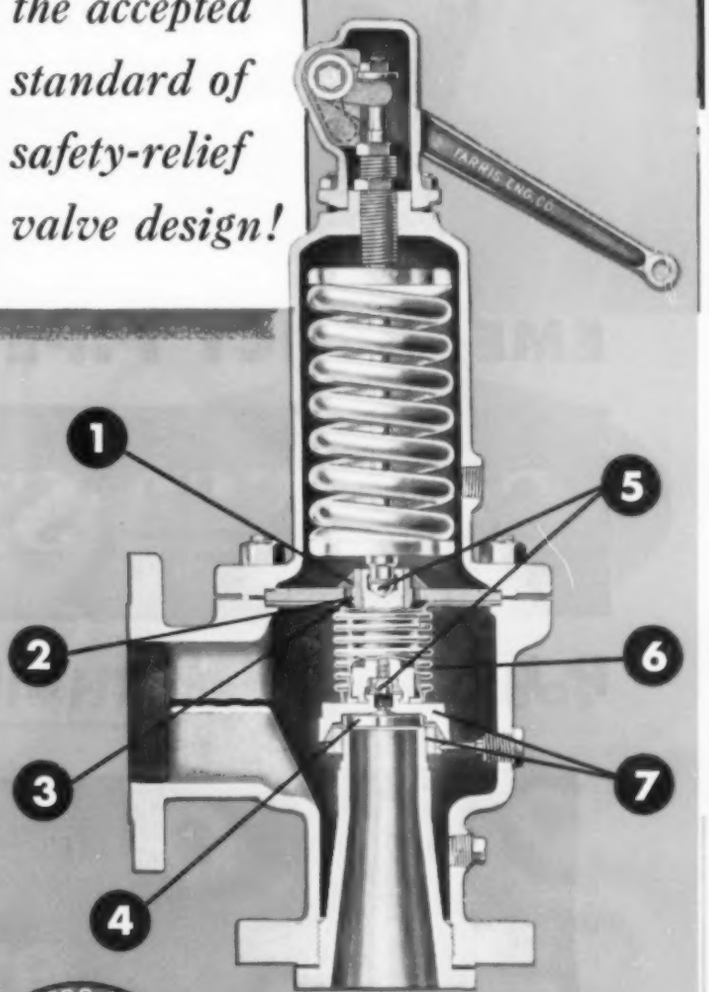
SAFETY-RELIEF VALVES

are your best buy

the accepted standard of safety-relief valve design!

Farris gave industry the ideal concept of a trouble-free, safe, safety-relief valve in 1945... and it has had little need for major design changes through the years. The proven excellence of design and construction has resulted in patent licensing to others, serving to reduce a confusion of designs which retarded the safety valve industry in prior years. Today, the Farris design—with or without its universally accepted optional "BalanSeal" bellows—represents the *standard* of the industry... it has been the standard for over 13 years.

With Farris valves in your process lines you'll know that another confusing design change isn't around the corner to plague you... you'll never worry about obsolescence of your spare parts inventory... you'll always benefit by integrity of materials in valve construction. You can be sure of all this because Farris full-performance valves have proven to be the *accredited leaders* in the field of safety.



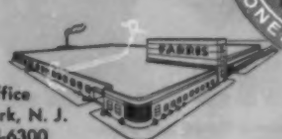
1. 2½ to 1 ratio—guide length to guide diameter—prevents galling and hanging up.
2. High thermal expansion rate of sleeve guide and low thermal expansion rate of hardened stem retainer eliminates binding and galling even at elevated temperatures.
3. Sleeve guide provides solid baffle between body and bonnet, shielding spring from lading fluid.
4. Hardened stainless steel optically lapped flat disc—self aligning for maximum tightness.
5. Double universal ball joint from stem to disc for self alignment—eliminates effects of spring, temperature and piping distortion.
6. Stainless steel stress relieved "BALANSEAL"® bellows nullifies effect of back pressure and isolates internal working parts from lading fluid.
7. Cone-shaped disc holder directs flow away from guiding surfaces and forms fixed secondary orifice with single blowdown ring control for built-in capacity.

PROGRESS THROUGH HONEST PURPOSE

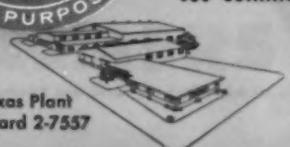
Farris ENGINEERING CORP.

535 Commercial Avenue, Palisades Park, N. J.

In Texas: 5405 Clinton Drive, Houston 20



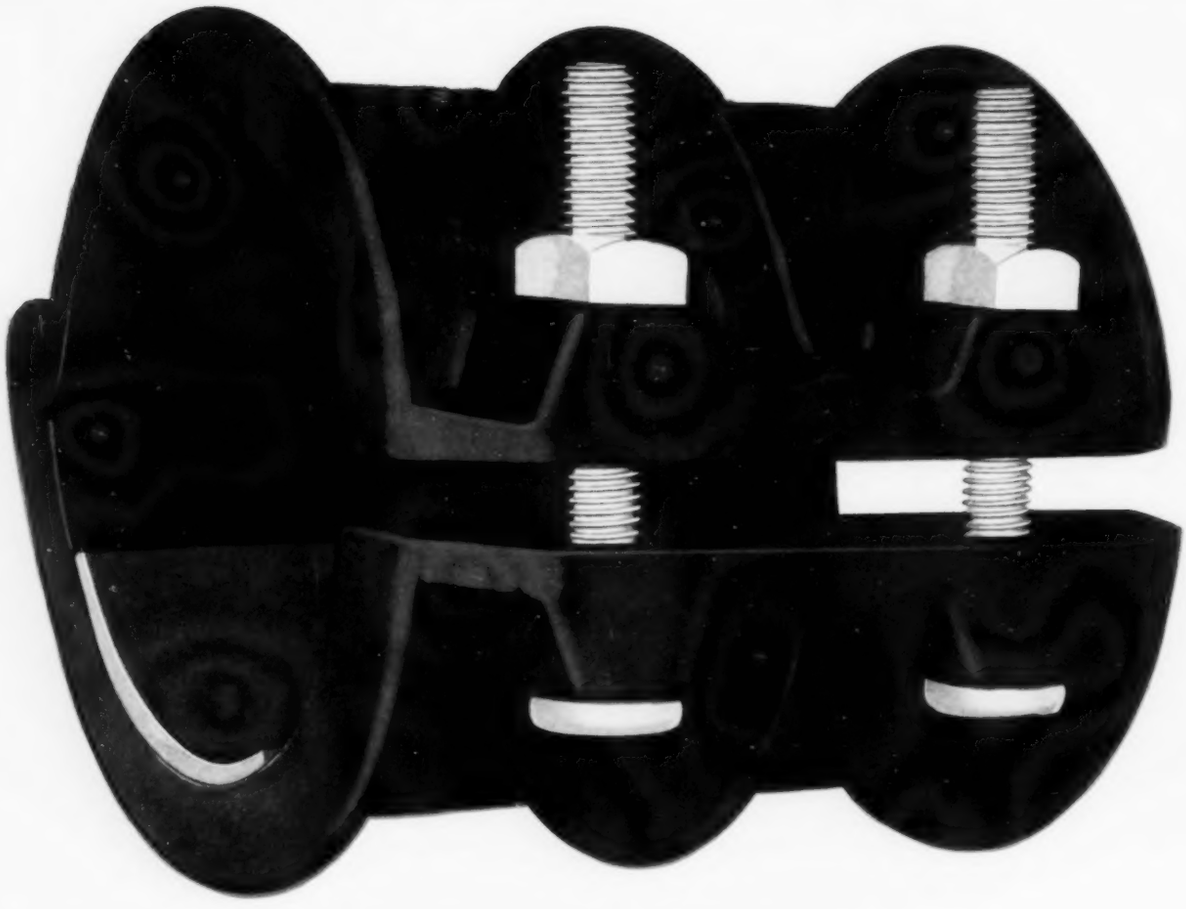
Main Office
Palisades Park, N. J.
Windsor 4-6300



Texas Plant
Orchard 2-7557

affiliates:

FARRIS FLEXIBLE VALVE CORPORATION
FARRIS PICKERING GOVERNOR CO., INC.
FARRIS HYDROTORQUE CORPORATION
FARRIS HYDROSEAL CORPORATION



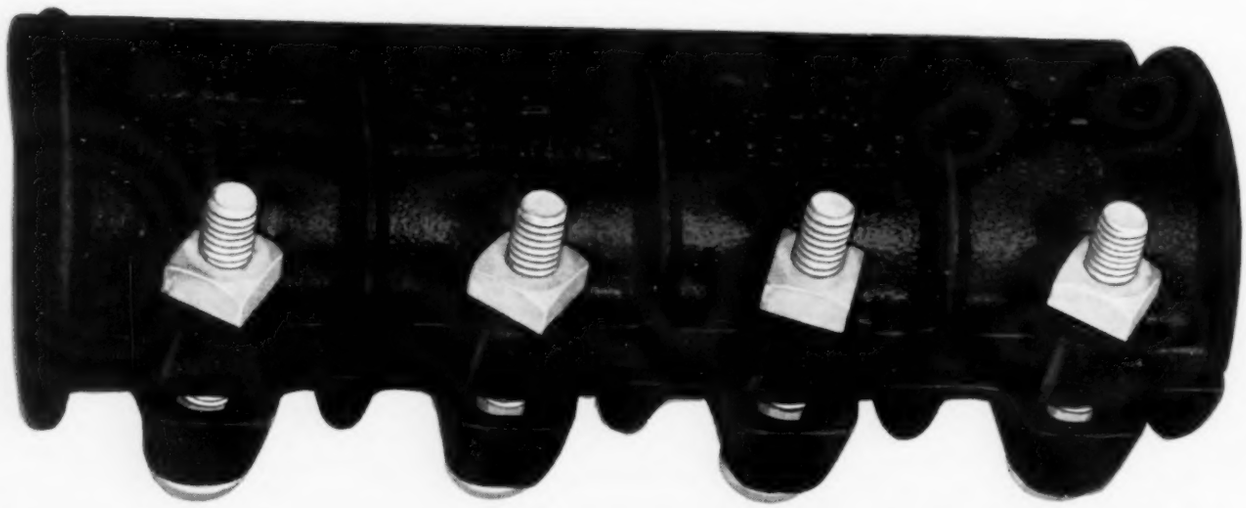
EMERGENCY PIPE CLAMP

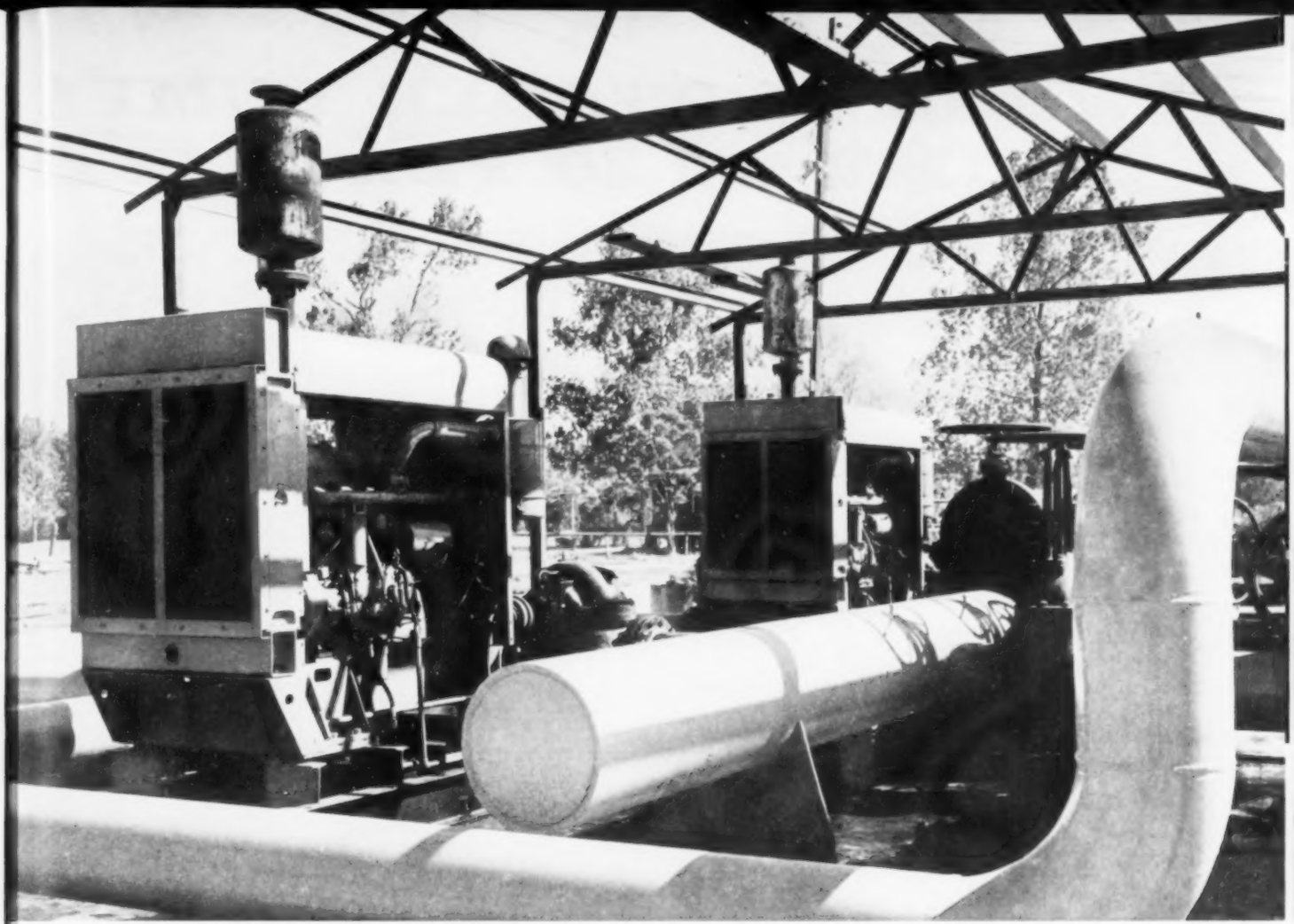
SKINNER-SEAL

PIPE LINE CLAMP

For repairing corrosion leaks and splits in pipe lines! Its action is definite and final under any pressure or temperature. Sizes ½" to 12" inclusive, for steel and also cast iron pipe. Stocked by most supply stores.

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA, U.S.A.





Two Allis-Chalmers 6DA 779 engines pumping crude oil from storage tanks through over 2,000 ft of 10-in. lines into tankers at a rate of about 6,000 lb per hour.

Allis-Chalmers Engines give you DO MORE POWER

That's RIGHT for your needs

RIGHT PERFORMANCE — Allis-Chalmers engines have *Do-More Power* — high torque, maximum work for each operating dollar.

RIGHT TYPE AND SIZE — There's a wide range of sizes and types, 9 to 516 hp — benefit from *Do-More Power* in *all* your equipment.

RIGHT FUEL — You can choose the fuel that's most practical — diesel, LP or natural gas or gasoline.

RIGHT SERVICE BACKING — wherever you are. Your Allis-Chalmers engine dealer has stocks of parts, backed by nearby company branch stocks. He also has factory-trained servicemen — complete facilities to give you prompt service.

See your Allis-Chalmers dealer for full details on *Do-More Power* engines that are right in every way for your job. Allis-Chalmers, Engine-Material Handling Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

10-7

THESE PORTABLE PUMPS PRIME AT 30 FEET LIFT!

PUMP AT REST
Captured liquid retained for priming. Note absence of the usual check valve.

PRIMING ACTION
Entrained air (B) escapes at (A) to be discharged. Priming liquid returns (C) to entrain more air.

PUMPING ACTION
Straight-in suction voids entrance restrictions. Water enters direct to the eye of the impeller.

When rain, springs or seepage is clobbering construction, it's good to have Gorman-Rupp "80" Series Pumps ready in the equipment pool.

These new pumps prime and reprime at lifts of up to 30 feet. They move easily because of their lightweight, aluminum construction. (The Midget weighs only 48 pounds.)

Look at the cutaway views. *Straight-in suction* delivers liquid directly to the impeller's eye. Capacity, efficiency and suction lift are increased. No *check valve*.

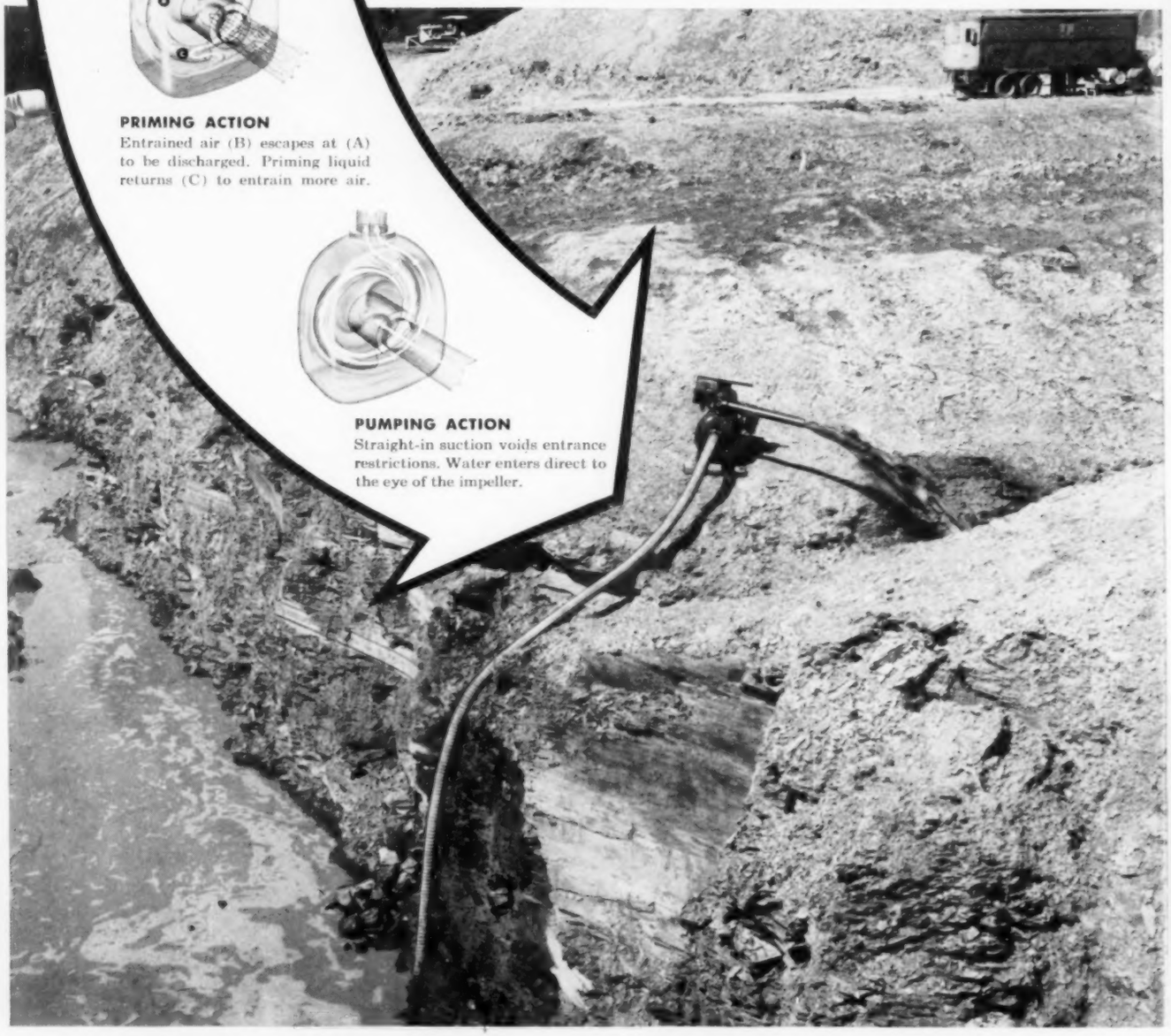
Four models:

Midget, $1\frac{1}{2}$", 6,500 GPH, 2.25 HP;
Pelican, 2", 8,500 GPH, 2.75 HP;
Hawk, 2", 12,000 GPH, 5.5 HP;
Eagle, 3", 18,000 GPH, 6.8 HP.

You saw them at the Road Show. Buy them now at your Gorman-Rupp Distributor.

THE GORMAN-RUPP COMPANY

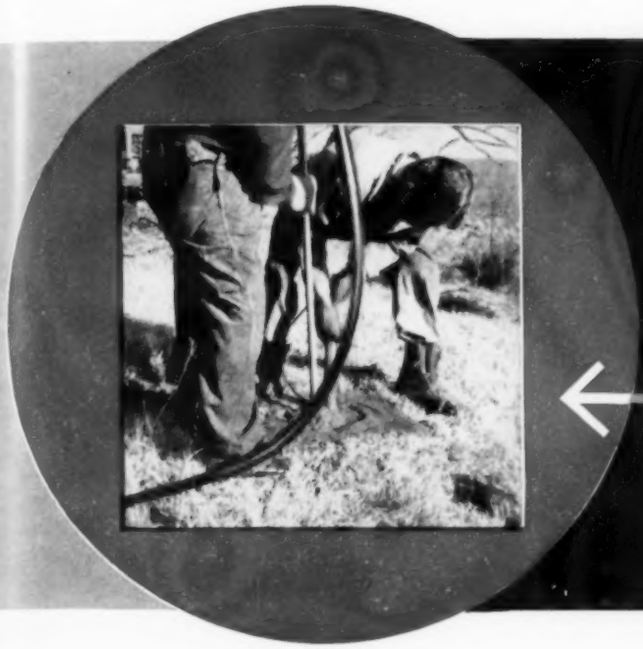
305 Bowman Street • Mansfield, Ohio



MIDWEST & GULF COAST OILFIELD REPRESENTATIVE: HENRY H. PARIS DISTRIBUTOR, INC., HOUSTON, TEXAS

For superior protection of underground structures

DURIRON® ANODES



3 year-old installation jetted in WITHOUT BACKFILL shows no loss of protection

This actual installation graphically demonstrates Duriron's ease of installation and economy factors.

Twenty Duriron Anodes were installed to protect a pipe line in a creek bed area where sandy soil prevented backfilling. These anodes were jetted into place in the vertical position using a high velocity stream of water, and were placed with the top of the anodes 3 feet below the surface. *Each anode was in position within 60 seconds.*

The group of anodes produced an average of 33 amps at 36 volts with no tendency to gas block. Actually, the bed resistance has decreased since the original installation. There was considerable cost-saving in the elimination of carbonaceous backfill.

- Duriron anodes, bare or with backfill, resist all current densities common to ground bed applications.
- Duriron resists all soils. Care required only when operating at high current densities in high chloride areas.
- Duriron has dense structure. Will not absorb moisture or gases causing breakdown. High weight factor gives longer life per anode size.
- Duriron has good electrical conductivity. Minimizes heavy current discharge near connection for uniform consumption.
- Duriron is mechanically strong. Metal-to-metal contact avoids loss of protection due to poor connection.

THE DURIRON COMPANY, INC.
DAYTON, OHIO

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

SEE BULLETIN DA/2

For superior protection of underground structures

DURIRON® ANODES

"Bimetal Freeze-up" Can Be More Serious Than Dial Fogging Problem

The first sign of moisture in a dial thermometer usually shows up as condensation inside the dial glass. You are probably familiar with this dial fogging problem which causes difficult reading and the eventual corrosion of the bimetallic element. You may not, however, be familiar with another and actually more serious moisture problem —bimetal "freeze-up."

Both dial fogging and bimetal freeze-up are permanently prevented by RMC's dry air hermetic sealing process.

If moisture is sealed in, or enters a thermometer dial it will find its way to the bimetal element. Then at extreme low temperatures this moisture freezes on the element and bearing surfaces, and the bimetal element will not function should the temperature go lower. Therefore, the operator of the equipment would never know that the temperature had gone below the last indication when the element became frozen.

Here's what makes such a condition hard to spot. The thermometer would operate properly again after a temperature rise of perhaps 20°, and would continue accurate indication even though the fluid dropped again to an even lower temperature than before. However, after it remained at the new low for a few hours, it would again freeze up. Then, as before, any further drop in temperature would not be indicated.

Only a dry-air hermetic seal, as used by RMC, can prevent both dial fogging and bimetal freeze-up. RMC even goes a step further by providing for recalibration at any time without breaking the air-tight seal. An external dial reset screw—exclusive with RMC—permits recalibration without opening the instrument in any way.

Industrial Needs Call For Magnetic Liquid Level Gauge

Magnetic drive provides accurate readings with complete safety in all types of liquids under pressure. RMC Magnetic Level Gauges meet requirements of the Underwriters' Laboratories and A.S.M.E. Boiler Code.

Write, wire or phone—tell us your requirements for indicating instruments, and let RMC engineering skill provide the answers. Rochester Mfg. Co., 207 Rockwood St., Rochester 10, N. Y.

These RMC thermometers have just been submerged in water for 15 minutes—the first of a series of severe tests given RMC thermometers to make sure hermetic seal is perfect.

We make certain that moisture will never bother your RMC thermometer

The RMC hermetic sealing process makes absolutely certain that humid air will not be sealed in the instrument and locks all moisture out permanently. Each thermometer then goes through a series of severe tests. Only those with perfect sealing are accepted for delivery. When you order from RMC you get the *only* industrial thermometer that can *never* be affected by internal dial fogging or bimetal freeze-up.

RMC

ROCHESTER MANUFACTURING CO., INC.
207 ROCKWOOD STREET • ROCHESTER 10, N.Y.

LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

REPRESENTATIVES IN ALL PRINCIPAL CITIES

STOP INTERNAL PIPE-LINE CORROSION!

CHANGE THIS

Corrosion-clogged pipe costs you money in down time, frequent scrapings, lost throughput, and discolored product.

TO THIS

This smooth interior surface means improved "C" factor, restored throughput.

with KONTOL 77 CORROSION INHIBITOR

Kontol-protected pipe eliminates the need for higher pump pressures to maintain throughput, requires fewer scrapings and avoids corrosion contamination of your products. Kontol 77 meets military specifications for use in jet fuels and automotive gasolines.

SEE WHAT KONTOL 77 DID FOR THIS PIPE LINE

	Date	"C" Factor	Use of Pigs
BEFORE KONTOL 77	May	125	4 knife scrapers, 1 brush scraper
	June	125	10 knife scrapers, 1 brush scraper
	July	127	6 knife scrapers
	August	130	20 knife scrapers
	September	132	26 knife scrapers
	October	138	18 knife scrapers
KONTOL 77 WAS USED HERE!	December	141	14 knife scrapers
	February	141	6 knife scrapers
	February (following year)	141	NO SCRAPERS FOR ENTIRE YEAR!

See your Kontol Service Engineer soon!

Chemicals and Services for the Petroleum Industry

DEMULSIFICATION • DESALTING • CORROSION INHIBITING
PARAFFIN REMOVAL • SCALE PREVENTION
WATER DE-OILING • INJECTIVITY STIMULATION

KPL-58-2

TRETOLITE COMPANY
DIVISIONS OF PETROLITE CORPORATION
369 Marshall Ave. • St. Louis 19, Mo.
5515 Telegraph Road • Los Angeles 22, Cal.

Now you can have

maximum protection

for every inch of underground piping with

Carey® asbestos pipeline felt

only 4% weight variation in 30,000 miles of felt — thanks to new **AccuRay**® process!

This AccuRay control system has watch-dogged the manufacture of more than 30,000 miles of Carey Pipeline Felt. During this time the average weight variation in the felt has been less than 4%—compared to the usual 30% average for standard quality control methods.

® Trade mark of Industrial Nucleonics, Inc.—originators of this advanced nucleonic process for measuring thickness.

It's just good business to choose the pipeline felt that gives you the greatest uniformity of weight, thickness and strength for maximum protection against corrosion. Of all pipe wrap manufacturers, only Carey can offer you this uniformity—because only Carey Asbestos Pipeline Felt is weight-controlled by nucleonic AccuRay. There can be no *weak spots* to cause you repair headaches in years to come. Write Dept. PLI-38 for complete information.

Carey Asbestos Pipeline Felt

THE PHILIP CAREY MFG. COMPANY
LOCKLAND, CINCINNATI 15, OHIO

Have "COFFEE WITH CAREY" at the 1958 N.A.C.E. Annual Exhibition
Booth 83 Civic Auditorium San Francisco

BENDIX OFFERS A COMPLETELY MODERN INDUSTRIAL ENGINE MAGNETO

UNMATCHED DESIGN FEATURES

Metal Encased

Fully Ball Bearing Equipped

Pivotless Aircraft Type Breaker

Impulse Coupling Provides for Complete Adjustment of Lag Angle and Lug Position

High Output at all Operating Speeds

Metal High Tension Outlet Plate and Feed-through Condenser on Shielded Magnetos

The reputation of Bendix* in the field of ignition is truly unmatched. From the history-making flight of Lindbergh to today's fastest jets, the aviation industry has always looked to Bendix for the latest and most efficient ignition equipment. Likewise in industrial ignition Bendix has set new standards of performance in applications ranging from small outboard motors to the largest industrial engines.

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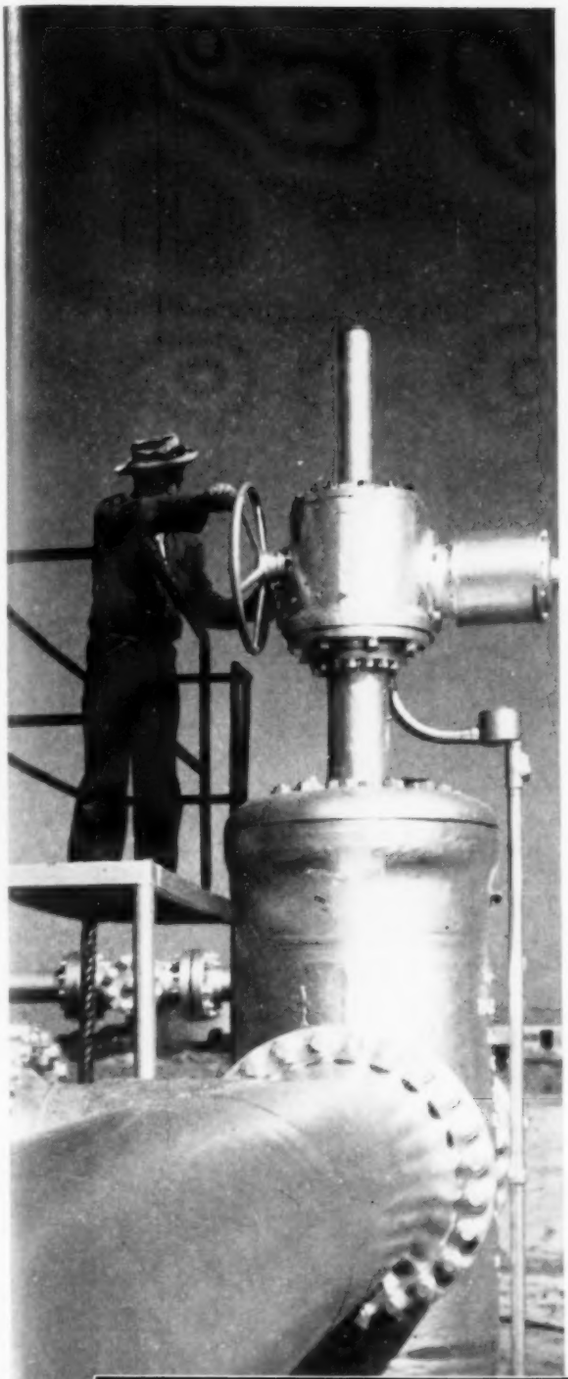

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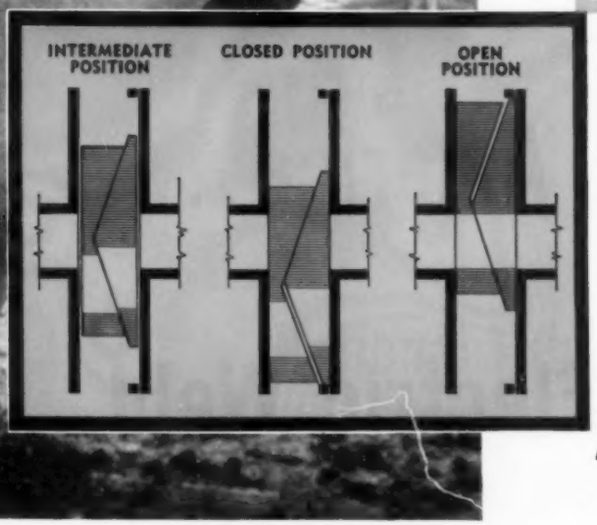

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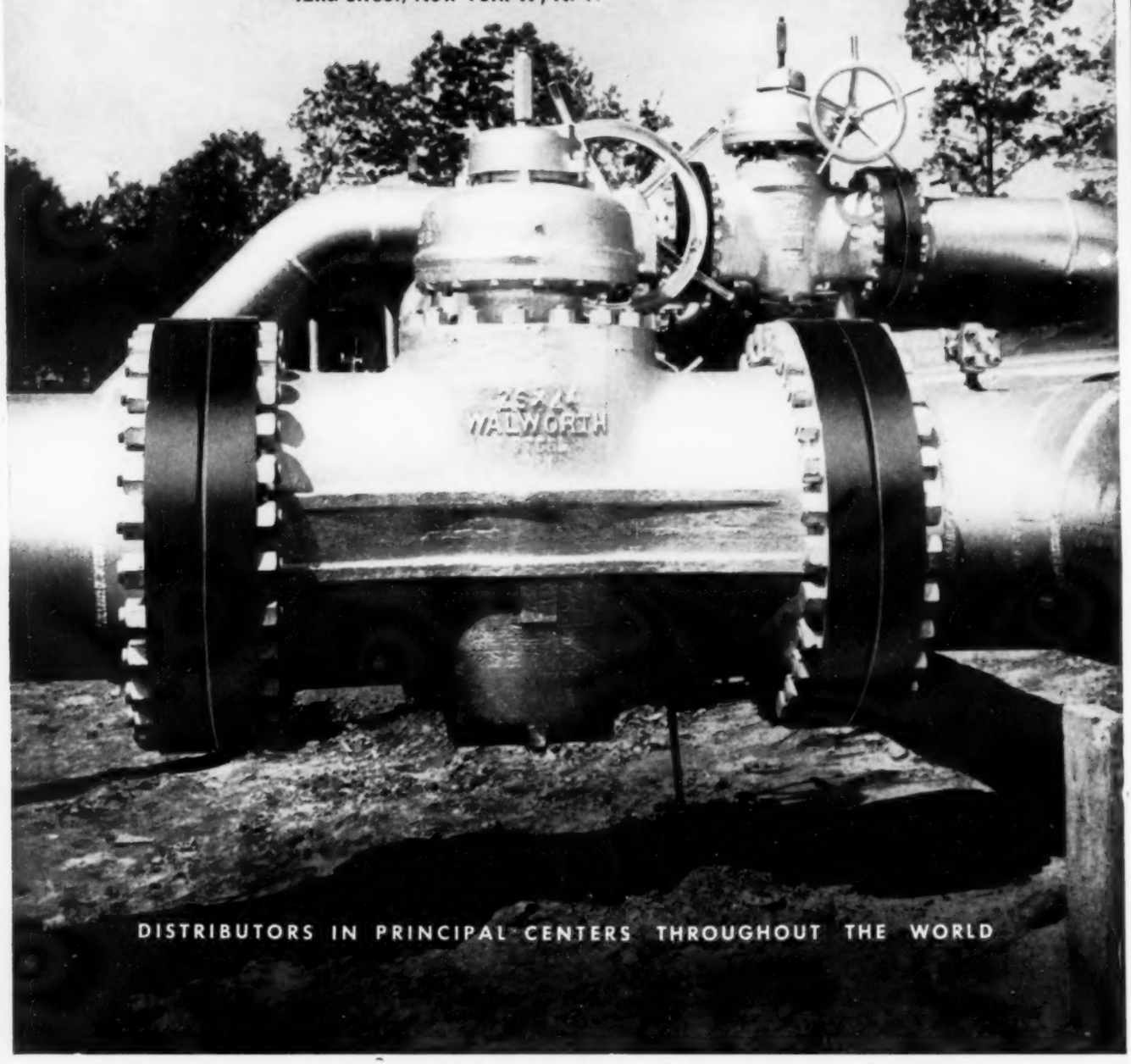

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The U-510 is one of the five sizes of general-service pumps manufactured by Bethlehem. Three are the duplex type; the others are triplex. They're precision-engineered units that do a whale of a job in lease gathering and pipe-line work, refinery and gasoline service, etc. This line of pumps is also highly suitable for water-flooding, salt-water disposal, and service around the drilling rig. Pressure, capacity, and fluid handled are the factors that determine the actual choice of unit.

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The pumps are so versatile, so adaptable to conditions, that you can employ them on job after job. Call us for more details; we'll see that you get complete information.

Bethlehem General-Service Pumps

Model	Type	Plunger Load, Lb	Input Hp	Bore & Stroke, In.
U-33	Duplex	2400	13 @ 160 rpm	1¾ to 3 x 3
UA-46	Duplex	5000	40 @ 120 rpm	2½ to 4 x 6
U-510	Duplex	12000	100 @ 75 rpm	3 to 5½ x 10
TP-3	Triplex	3580	36 @ 400 rpm (max)	1¾ to 2¼ x 3
TP-4	Triplex	5000	67 @ 400 rpm (max)	2 to 4 x 4

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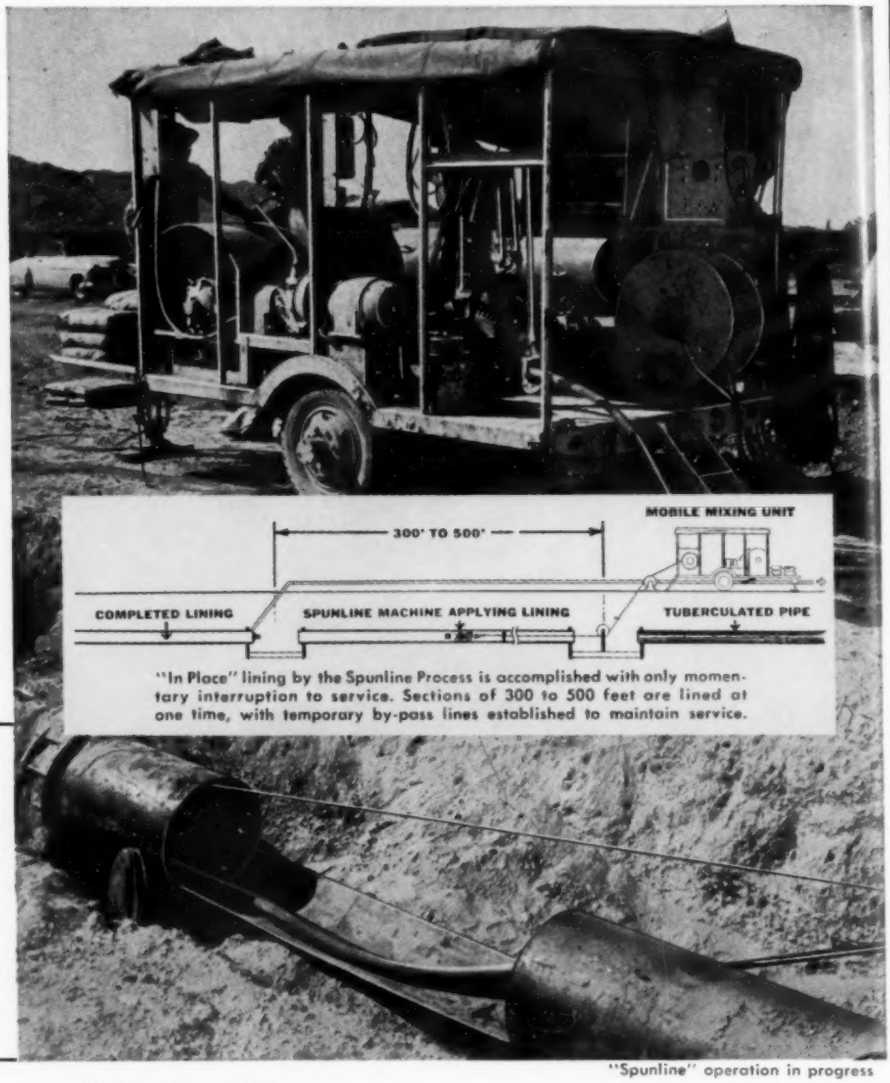
NEW! "Spunline" Process for cement mortar lining of pipe interiors "in place"

- for pipes 6" to 16" in diameter *(particularly cast iron)*
- Combines best features of world-famous Tate and centrifugal lining processes



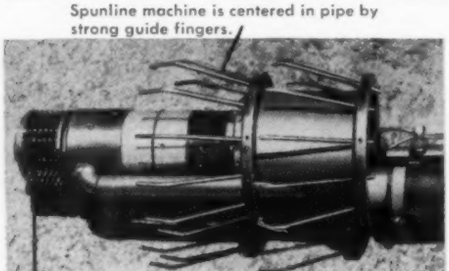
"In Place" lining by the Spunline Process is accomplished with only momentary interruption to service. Sections of 300 to 500 feet are lined at one time, with temporary by-pass lines established to maintain service.

"Spunline" operation in progress

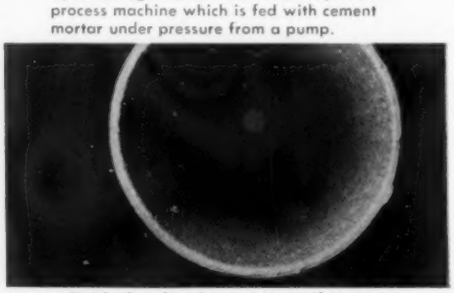
ONLY MOMENTARY INTERRUPTION TO SERVICE!

Gives new pipe performance
Restores flow coefficients
Reduces leakage
Reduces pumping and maintenance costs
Protects against corrosion, contamination, and water discoloration at much less than the cost of installing a new line

Spunline machine is centered in pipe by strong guide fingers.



Mortar is placed in uninterrupted continuity by centrifugal head of this new "Spunline" process machine which is fed with cement mortar under pressure from a pump.



Finished surface has orange peel texture.

HOW IT'S DONE

The "Spunline" process might be called a "marriage" of the conventional "in place" Tate and centrifugal processes.

It is a process of applying a cement mortar lining "in place" to small diameter pipe, developed to provide a thin lining for prevention of further interior corrosion and to restore hydraulic flow, particularly in cast iron pipe. The mortar is placed in uninterrupted continuity by a centrifugal machine (a centrifugally rotating head) projecting the mortar against the wall of the pipe (pulled through, as in the Tate process) with minimum rebound and with sufficient velocity to cause the mortar to be densely packed and adhere in place. The finished thickness of the mortar lining may be ⅛" or more, with a plus or minus variation of 1/16". The finished surface is not troweled and has an orange peel texture.

Why you'll like the "Spunline" Process

1. Lining can be carried through many bends and certain fittings.
2. Lining can go right past smaller openings or corporation stops . . . no need for plugging such openings.
3. Lining can be thinner than usually applied by other processes, with closer tolerances.
4. Compares favorably in cost with other methods.

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PIPE LINE PANORAMA

Washington Panorama . . . Fate of at least 34 major pipe line companies is now in hands of Supreme Court—and may remain there for the rest of the year. Court has refused Justice Department request for early hearing, may not get around to hearing arguments until fall. (See "Memphis Couldn't Have Known," Page 4.) If decision isn't favorable, there is excellent chance the pipe line industry and Federal Power Commission will be tied up in a knot only Congressional legislation can untie.

Meanwhile, the fate of natural gas producers is also embroiled in a tense game of political football. Following up advantage gained from the Porter letter debacle, big city mayors have launched new attack on Harris-O'Hara bill—are calling for another poll to determine Congressional feelings on the issue. Natural gas interests and FPC are continuing efforts to have bill considered on its merits, instead of a few extra votes for politicans.

Because of these two issues, big government is getting bigger. Giving argument that natural gas and pipe line industry rate cases have created three-year backlog of work, FPC has requested emergency funds to hire 48 new employes.

New Weapons to Fight Corrosion . . . Laboratory studies show coating of pipe in storage will cut corrosion costs. (See Page 36.) Since 1954, more than 1,100 miles of large diameter pipe have been protected in this manner. Also, coating of lines in service will reduce interior friction, increasing efficiency 6 to 10 percent.

New equipment has been developed for application of thin film coatings for external protection of pipe lines. Previously, coatings were applied with spray gun, resulting in considerable waste from overspray.

New method: Standard pipe line priming machine has been converted to apply such materials as coal tar epoxies. Field tests show that machine is easy to handle, eliminates waste and is much less bulky than equipment now in use. (See Page 48.)

Needed: More Natural Gas Reserves . . . According to recent estimates, natural gas recoverable from presently proved reserves and future discoveries in the U. S., including offshore supplies, will exceed 1,200 trillion cubic feet. However, industry experts say at least 80 percent of supply needed to meet future demand must yet be discovered. Estimates are that demand for natural gas will increase at average rate of 4.7 percent a year during next decade.

Await Green Light for Texas-Los Angeles Gas Line . . . Pending approval from FPC and California Utilities Commission, Transwestern Pipeline Company will start construction next fall on 950-mile section of 1,200-mile West Texas to Los Angeles gas pipe line system. Cost of initial section: $200 million. Pacific Lighting Gas Supply has signed 20-year agreement for initial delivery of 350 million cubic feet per day of Texas, New Mexico and Four Corners gas. Line may ultimately carry 640 million cubic feet per day.

Road Program Poses Problems for Pipe Lines . . . Unless there is close cooperation between road planners and pipe line engineers, tax payers and transmission companies stand to lose plenty in 41,000-mile interstate highway program. Here are the reasons:

- Highway departments will have to use tax money to reimburse pipe line companies for material and labor costs, as well as gas lost in relocating facilities. This will run into millions.
- Also, sale price of gas which transmission companies are unable to deliver while lines are out of service will never be recovered.

Visual Evidence of Coating Theories

Laboratory and field data indicate reduced friction losses with internally coated pipe.

By John C. Watts, Engineering Editor, PIPE LINE INDUSTRY

INCREASING THE efficiency of their lines is a major objective of gas transmission companies. A higher efficiency would mean increased earnings with the same investment and operating costs. The most promising way to accomplish this is to provide and maintain the smoothest possible interior surface in the pipe.

Of major interest at the present is the use of coatings to protect pipe in storage and provide a smoother interior surface. Since 1954, over 1,100 miles of large diameter pipe has been protected in this manner. Laboratory studies indicate reduced friction loss in coated pipe will give increases in efficiency of from 6 to 10 percent.

Corrosion in Storage Reduced. Corrosion of pipe in storage and during hydrostatic testing of a new line is serious enough to effect the efficiency. For this reason coating of the individual joints before construction is proving economical. Companies using this system report substantial savings in clean-up of the new line, and excellent efficiencies for coated lines. Since the coating is not applied for permanent corrosion protection, a thin film (from 1 to 2 mils) is considered satisfactory. Maximum smoothness of the pipe is not possible with this method since in many cases surface irregularities on the pipe surface will be greater than the 2 mil coating. Also, welding will destroy the coating from 0.5 to 1 inch at the joints.

From lines coated for protection during storage, some data has been gathered in regard to increased efficiency. Using a roughness gage, pipe as it came out of the mill was found to have an average roughness of 0.7 of a mil, with the minimum roughness being from 0.4 to 0.5. Pipe having this minimum roughness was considered to have 100 percent efficiency. Pipe which had been exposed to the atmosphere from 6 to 24 months had a roughness of 2 mils. The average roughness of coated pipe was 0.28 mils, which gives a theoretical increase in efficiency over pipe as it comes out of the mill of 8 percent.

Lack of follow-up tests on pipe in service prevents correlation of these figures with field data. Coated pipe has been installed in loops scattered throughout the system, with no provision having been made for accurate measurement of the efficiency.

Maintaining Efficiency in Service. Although natural gas has been treated and is not considered to be corrosive when it reaches the transmission line, there is enough corrosion to effect efficiency and in some cases cause contamination. El Paso Natural Gas has reported increases in efficiency averaging over 10 percent by cleaning existing lines, with the largest increase being over 30 percent.

Contaminants on the pipe surface include corrosion scale, compressor oil, dust, liquefied hydrocarbons and miscellaneous injected chemicals such as glycol. Continued build-up of these materials over a period of time will seriously effect efficiency of the line. Periodic cleaning will increase the efficiency, but the process will begin all over again, and the efficiency will begin to drop. Internal coatings offer a possible solution to this problem. Internal corrosion will be prevented, and as experience has shown in the mitigation of paraffin deposition in crude lines, the plastic offers a slick surface which resists depositions.

Many Miles Already in Service. Having proved its value with many successful applications for corrosion protection, the in-place method of application can make it possible to return the miles of gas transmission line already in service to peak efficiency. Photomacrographs of samples cut from actual jobs demonstrate smoothness of the surface provided by in place coatings. Surface imperfections are covered and a continuous smooth lining, with no gaps at the joints is obtained.

Photos Prove Cleaning Effective. A series of photomacrographs (Figures 1 through 5), illustrate the effectiveness of in place cleaning. Comparing Figures 1 and 2 demonstrates the need for more than mechanical and detergent cleaning. These two samples were cut from pipe in the same area. Mechanical scraping with solvent and detergent cleaning were used in cleaning the first example. As shown in Figure 1, although to the naked eye the pipe appeared clean, a film of surface contaminants is still present between the coating and the pipe. In cleaning the second section (Figure 2) chlorinated and aromatic solvents followed by acid treatment were included in the procedure. No foreign matter can be seen between the coating and the pipe. Even the

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deepest pits are clean and filled with the coating material.

Figures 3 and 4 show samples of the same pipe cleaned and coated in the laboratory. The same cleaning system used in Figure 1 was used for Figure 3. Stoddard solvent and chlorinated hydrocarbons were used to clean Figure 4. The sample shown in Figure 5 was also cut from an actual job. An acid rinse was used in cleaning this line, but without sufficient mechanical abrasion. Comparing these three examples with Figure 2 illustrates the need for a combination of a high degree of mechanical abrasion and chemical action to obtain optimum cleaning.

Coating Fills Crevices. Comparing the samples prepared in the laboratory with Figure 2 substantiates the argument that in the double opposed plug applications the coating is forced into all surface imperfections. Where the coating is applied by spray or spread by hand, pockets of air can be trapped under the coating. Many times these air pockets are the cause of blistering of the coating.

Further information illustrated by these pictures is the lack of solvent bubbles in the in-place applied coating when the film thickness is under 10 mils. A solvent bubble is present in Figure 1 where the coating thickness is approximately 15 mils. There is also evidence of trapped solvent in the laboratory samples even though excess thickness was not applied.

An explanation for this phenomenon lies in the method of drying employed in the in-place application. The confined atmosphere of the pipe makes it possible to carefully control drying rates, keeping the surface of the coating wet and letting the drying proceed from the surface of the pipe out. In this way, solvent bubbles are not trapped in the film.

Better Understanding Provided. From these photomacrographs the following conclusions can be drawn:

- Coatings provide a smooth interior pipe surface.
- Optimum surface preparation requires a combination of mechanical abrasion and acid cleaning.
- Double opposed plug application forces the coating into minute crevices in the steel.
- Films of up to 10 mils can be applied in one coat without solvent entrainment.

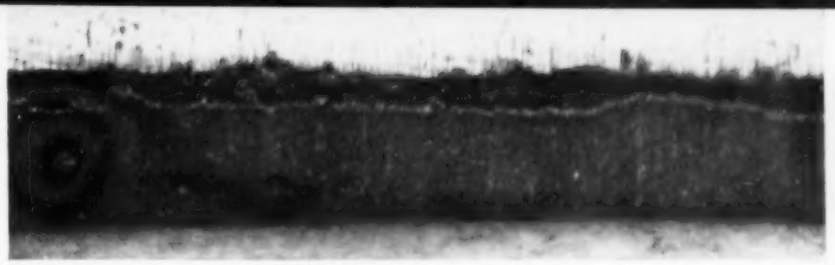

FIGURE 1—Sample cut from in-place coated used pipe. Cleaning was by mechanical abrasion, using Stoddard solvent and detergents. Amine-cured epoxy applied by double opposed plug method. Thickness of coating 15 mils. Magnification of picture, X-40.

FIGURE 2—Sample cut from in-place coated used pipe. Cleaning was by mechanical abrasion, using Stoddard solvent, chlorinated and aromatic solvents and detergents, followed by acid treatment. Amine-cured epoxy applied by double opposed plug method. Thickness 9 mils. Magnification X-40.

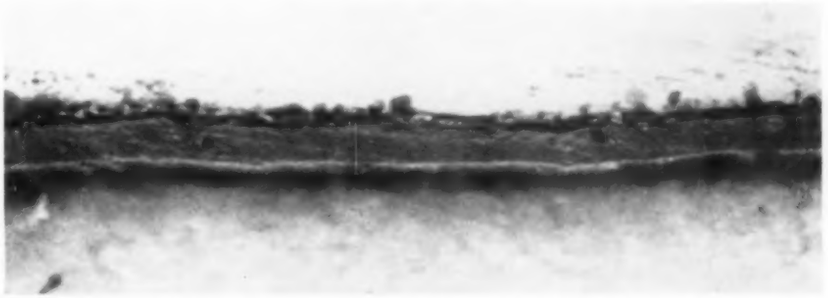

FIGURE 3—Sample cut from same line as Figures 1 and 2. Cleaned in laboratory by wire brushing using Stoddard solvent and detergents. Amine-cured epoxy coating applied by hand. Thickness of coating 4 mils. Magnification X-40.

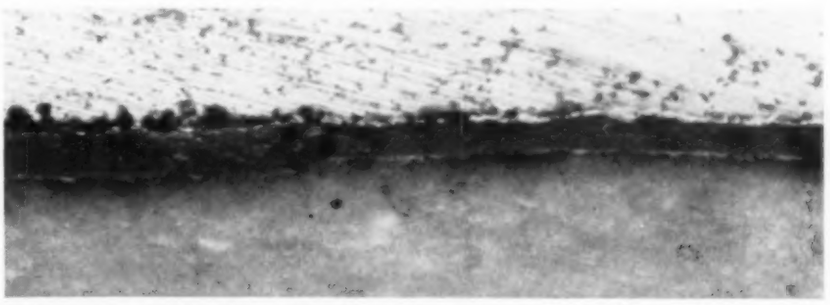

FIGURE 4—Sample cut from same line as Figures 1, 2 and 3. Cleaned in laboratory by wire brushing using Stoddard solvent and chlorinated solvents. Amine-cured epoxy coating applied by hand. Thickness of coating 4 mils. Magnification X-40.

FIGURE 5—Sample cut from in-place coated new pipe. Cleaning was by wire brush plug, Stoddard solvent and detergents, followed by acid treatment. Amine-cured epoxy coating applied by single plug method. Thickness of coating 9 mils. Magnification X-40.

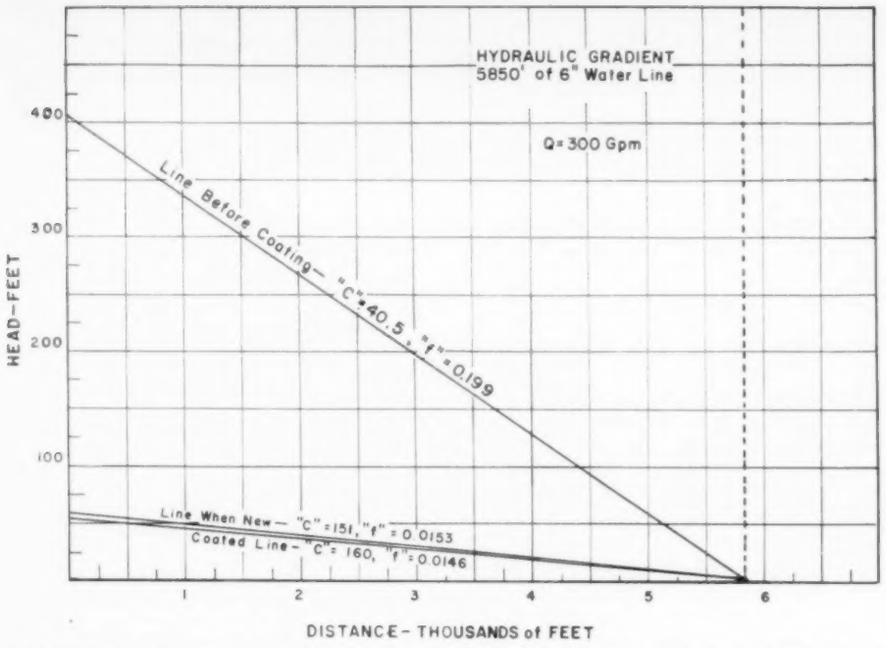

FIGURE 6—Hydraulic gradient for 6-inch water line when new, before cleaning and coating, and after cleaning and coating. Data shown graphically confirms theoretical calculations based on measurements made with roughness gage.

Coated Lines Indicate Increase. Although no lines have as yet been coated exclusively to increase the capacity of the line, this has been a noticeable side effect in many cases. Increased capacity first became apparent in a water line in 1950. Since that time, the increase in throughput has been checked closely for several gas and water lines.

Indications of decreased surface resistance and its beneficial effect on throughput are strong enough that several companies are seriously considering a controlled test to check theoretical calculations. Most of the interest is being shown by gas transmission companies since efficiency in their lines is much more critical.

A study of the feasibility of internally coating pipe in gas service is being conducted by the Institute of Gas Technology. Sponsored by the pipe line research committee of the American Gas Association, this study includes a survey of the literature and industry practice, and laboratory investigation of chemical and physical properties of coating materials.

Scale in Untreated Gas Lines. In field gathering lines which handle untreated or partially treated gas, scale build-up is much more rapid. Due to severe internal corrosion and consequent scale build-up, a 20-inch gas line, in addition to developing leaks, would not handle the necessary volume of gas at the desired pressure. Before cleaning and coating, the efficiency of the line had dropped to 46.7 percent, as computed by the Panhandle Formula. Cleaning and coating the line increased the efficiency to 98.7 percent.

At the required flow of 29.5 MMcf per day, before coating there was a 30 pound per square inch pressure drop in the line. After coating, the pressure drop was 6 psi. With the same pressure drop after coating, the flow would have been 62.4 MMcf, an increase of 47.2 percent. For comparison purposes, assuming 92 percent efficiency, which is the figure used for new pipe, the pressure drop at a flow of 29.5 MMcf would have been 7 psi. A summary of the results of tests conducted on this line is given in Table 1.

TABLE 1
Effect of Internal Coating on 20-Inch Gas Line

	Before Coating	After Coating	Increase (+) Decrease (—)
Inlet Pressure, psi	51	45	—6
Discharge Pressure, psi	21	39	+18
Pressure Drop, psi	30	6	—24
Throughput, MMCF	29.5	29.5	0
Efficiency, percent	46.7	98.7	+52

Pumping Costs Reduced. As a corrosion preventative measure, 92,000 feet of 14-inch pipe was internally coated in place. After the coating application was complete, the company made a comprehensive study of the capacity of the line. It was found that the Hazen and Williams "C" Factor has been increased from 75 to 147. After returning the line to service, a flow of 2,170 gpm was being obtained with a friction loss of 25.2 psi per mile. This represents a 26 percent increase in capacity at reduced pumping pressures. Because of the reduced friction loss, the company estimates they will save almost $17,000 a year in power costs, which is a savings of 4.6 percent. Although it was not the reason for coating the line, the savings in pumping costs will pay for the coating in 5.3 years. A summary of the results of these tests is shown in Table 2.

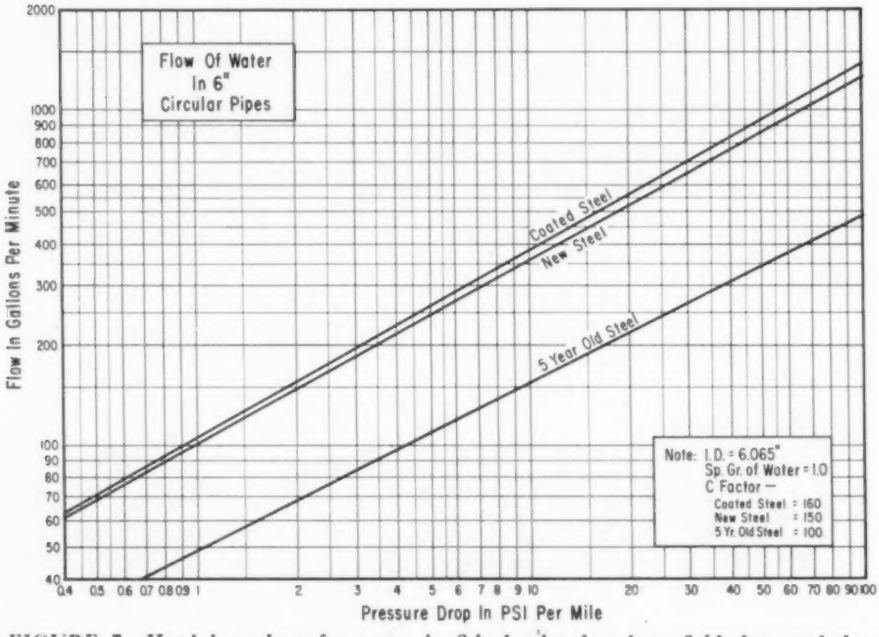

FIGURE 7—Head loss chart for water in 6-inch pipe based on field data and data obtained with a roughness gage.

TABLE 2

Effect of Internal Coating on 14-Inch Water Line

	Before Coating	After Coating	Increase (+) Decrease (−)
Static Head, psi	82	82	0
Friction Head, psi	433	346	−87
Total Head, psi	515	428	−87
Flow, gpm	1,750	2,170	+420
Power, HP	654	624	−30
"C" Factor	75	147	+72
Pumping Costs, $/yr.	$367,300	$350,463	−$16,867

Theoretical Calculations for Water Lines. As a result of increased interest in the use of internal coatings for increasing the capacity of lines, and encouraged by field tests on lines that have been coated, a theoretical study was made to arrive at the actual effect coating had on the relative roughness of steel pipe. Since most of the accurate field data were taken from water lines, this initial study concerned pipe in this service in order to check the correlation of the theoretical figures. The same theory can be applied to pipe in other services.

Until recently, there was no way to accurately measure the minute irregularities which exist on the metal surface. The average pipe roughness was calculated, using data obtained through pressure loss tests on artificially roughed pipe. Through those tests, tables were developed giving the roughness of pipes of various materials. These tables are still in general use for design purposes and for checking fluid flow in pipe.

Surface Roughness Accurately Measured. Instruments have been developed which accurately measure surface imperfections. These instruments automatically average the deviation from the mean surface, giving the reading in microinches (0.000001). The mean surface is defined as a straight line that divides the surface profile in such a way that the areas above and below it are equal.

Using one of these instruments on several samples of new internally coated steel pipe showed an absolute roughness of 160 microinches, as opposed to 575 microinches for bare steel. This was confirmed by data from an actual job. The hydraulic gradient of the line is shown in Figure 6. Using the figure of 160 microinches as the absolute roughness and calculating the pressure drop in the line gave a "C" factor of 160. Using an absolute roughness of 575 and calculating the pressure drop when the line was new agrees with the "C" factor of 150.

FIGURE 8—Equipment used to coat large-diameter pipe for protection during storage and hydrostatic testing. Over 1,100 miles of gas transmission line have been coated in this manner.

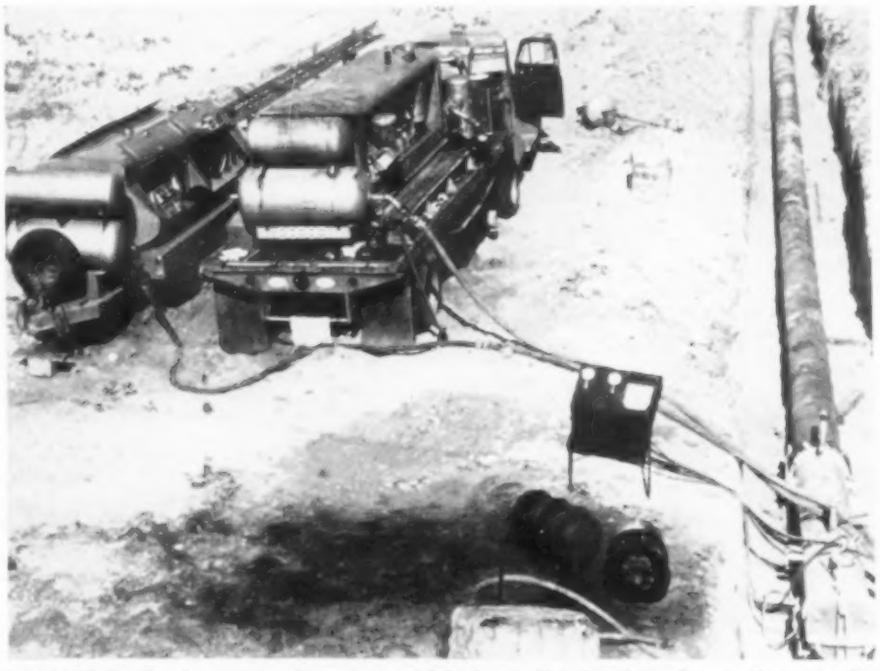

FIGURE 9—Equipment used to coat a 20-inch gas line in place. Large diameter pipe requires large amounts of air and air operated "pup joint." Recording air pressures allows check on progress of work.

Based on these figures, calculations were made and a family of curves drawn up for water lines of various sizes. Figure 7 shows one of these curves. Curves were plotted for "C" factors of 160, 150 and 100. From these curves, the effect of internal coatings can be calculated. As an example, in a new 6-inch line handling 1000 gpm, internal coating will decrease the pressure drop over the drop in new uncoated steel from 65 psi per mile to 55 psi per mile, which is a decrease of 6 percent.

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ACKNOWLEDGMENT

Pipe Line Industry wishes to thank the Humble Oil & Refining Company for the use of the photomacrographs.

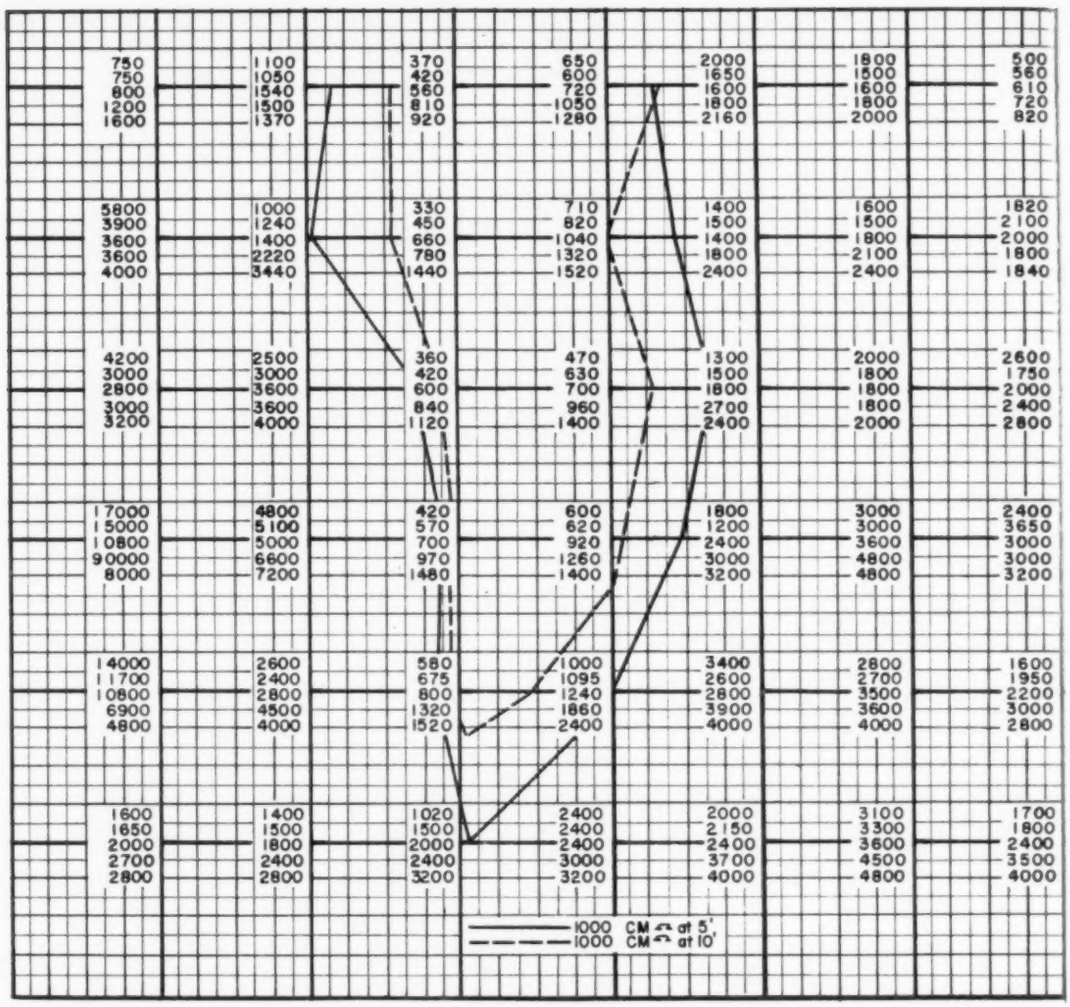


FIGURE 1—Equi-resistivity contour plat presents results of 4-point soil survey at depths of 5 and 10 feet. Readings were taken at 5 different spacings on 100-foot centers.

Design to Cut Cathodic Protection Costs

A careful preliminary survey will help select the ground bed sites that will be the least expensive—both to install and maintain.

By O. W. Everett,
Oklahoma Natural Gas Company, Tulsa

IN ANY pipe line corrosion control program, management measures its success with an economic yardstick. While it is always advisable to use the best engineering in the design of an installation, it is just as important to keep some sound rules of thumb in mind when applying a design to the field problem.

Location of the ground bed is the most important consideration in a cathodic protection rectifier installation. Selecting a site with a low resistivity soil is generally preferable to choosing a location because of its position on the line. A 1 ohm ground bed is fairly easy to obtain, but a ½ ohm bed, which would be 100 percent more efficient, is often hard to locate.

If a large rectifier is required it is essential to install the ground bed in the lowest resistivity soil possible, as this will have a direct relation to power costs. If the unit is to be small enough that the power bill would be under the minimum rate charged by the power company, the problem of ground bed resistance will not be so important.

Survey ROW First. It is usually a good policy to drive the length of the line and make a number of observations at the road crossings. During this preliminary survey five factors are especially important.

1. A power source must be available

at proposed ground bed sites.

2. Foreign structures should be avoided. Minimum distance will vary with current demands. Where a small unit is to be installed, one-quarter mile is usually sufficient; with larger units this distance should be increased.

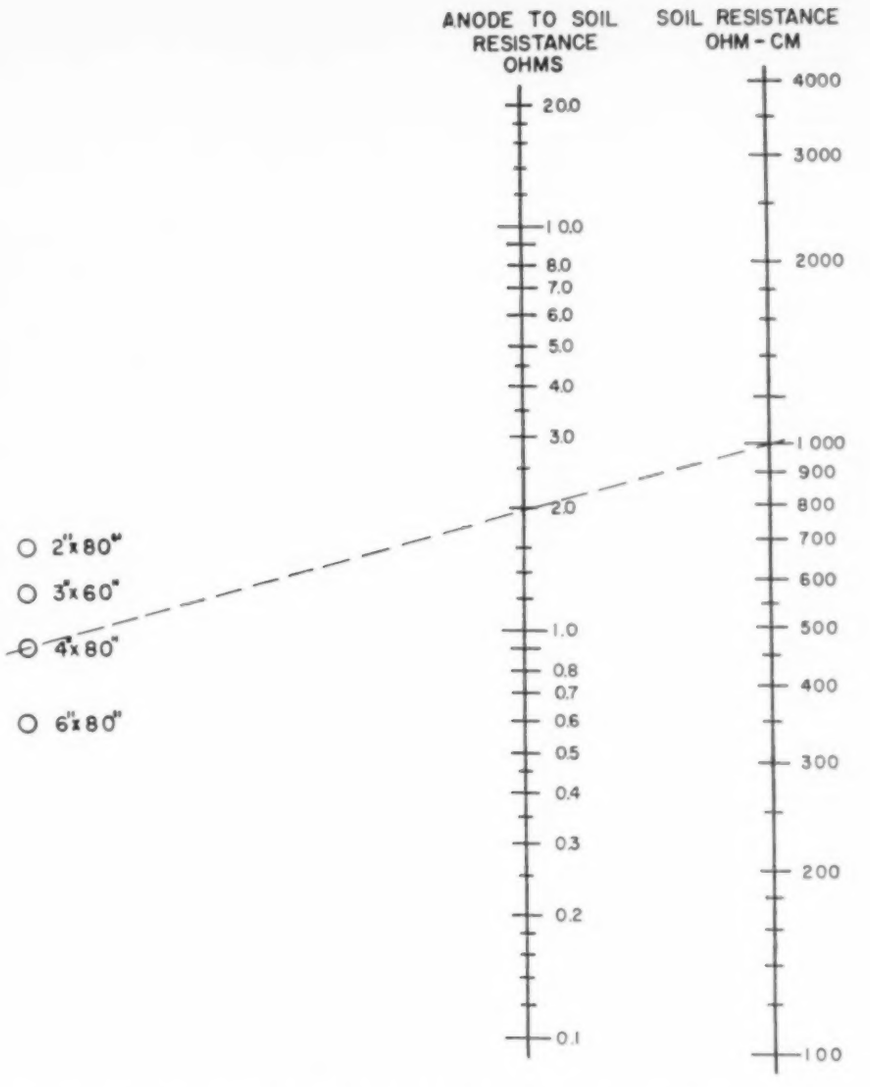
3. Rectifier sites chosen should be accessible for installation, inspection, and maintenance.

4. Practicability of acquiring right-of-way.

5. Inspector's familarity with locality. One familiar with the area can, by observation, get a fairly good idea as to soil resistivity.

Making Resistivity Survey. Low resistivity soil at the ground bed is important, but one or more of the factors considered in the initial survey may force a second choice. After a likely site has been selected, a soil survey should be made.

The contour four-point method, using a four-pole earth resistivity instrument is the most practical. Results of a typical survey are shown in Figure 1; the equi-resistivity contour plat has lines of equal resistivity observed at depths of 5 and 10 feet. Readings were taken at five different spacings on 100-foot centers. If the 100-foot locations are accurately measured and measurements are started from a reference point on the original pipe line survey, the problem of defining the limits of the actual ground bed is practically solved.



Note: For soils with resistance higher than shown, divide soil resistance by multiple of 10 and multiply anode to soil resistance read from chart by that factor.

FIGURE 2—Resistance of a single vertical graphite ground rod to remote earth may be quickly read from this nomograph. Values are for an anode in a tamped coke backfill of three rod diameters.

Ground Bed Materials. Graphite anodes are made in 2-,3-,4-and 6-inch diameters and in 60- and 80-inch lengths. In practice they are generally installed in some backfill, such as coke breeze, which gives the effect of a large porous rod and transfers any consumption of the anode material away from the main rod. Rods can be installed either vertically or horizontally. Because of depth advantage, better moisture conditions, and easier tamping of backfill the vertical installation is generally preferred over the horizontal trench.

Junk pipe can be used as a ground anode. Length has more effect in lowering the resistance to earth than size. For instance, a junked boiler may have a large quantity of metal in it but the same amount of metal in a 6-inch pipe would have much less resistance to earth. Rails or any other current conducting material may also be used.

A high silicon (14.5 percent) cast iron anode has a very low consumption rate, even at high current densities. It is a very good material for use in cathodic protection systems employing impressed currents; especially so for water tanks or towers.

Check Cable Corrosion. Cable used to connect the ground bed to the positive side of the rectifier can become subject to severe corrosion by impressed currents if not well insulated. A rubber covered, neoprene jacketed wire is recommended by many corrosion engineers. Also, the joints must be tight and thoroughly insulated. One good way to do this inexpensively is by using flower pots in which the connection is surrounded with coal tar enamel.

Connections may be made by a thermite-type weld or by use of a split bolt solderless connector. Care should be used in selecting the proper size cable to avoid as much potential drop as possible without going beyond the point of economic limits. This point is not always controlled by current demands; price and availability are also contributing factors.

Designing the Ground Bed. On well coated lines, with systems using small rectifiers, a distance of 30 to 50 feet between the ground bed and the pipe line may be adequate. However, to avoid possible damage to coatings caused by high potential drops adjacent to the ground bed, as well as an excessively high pipe to soil potential there, a 100-foot minimum has been adopted by Oklahoma Natural. If the pipe is poorly coated, or bare, the

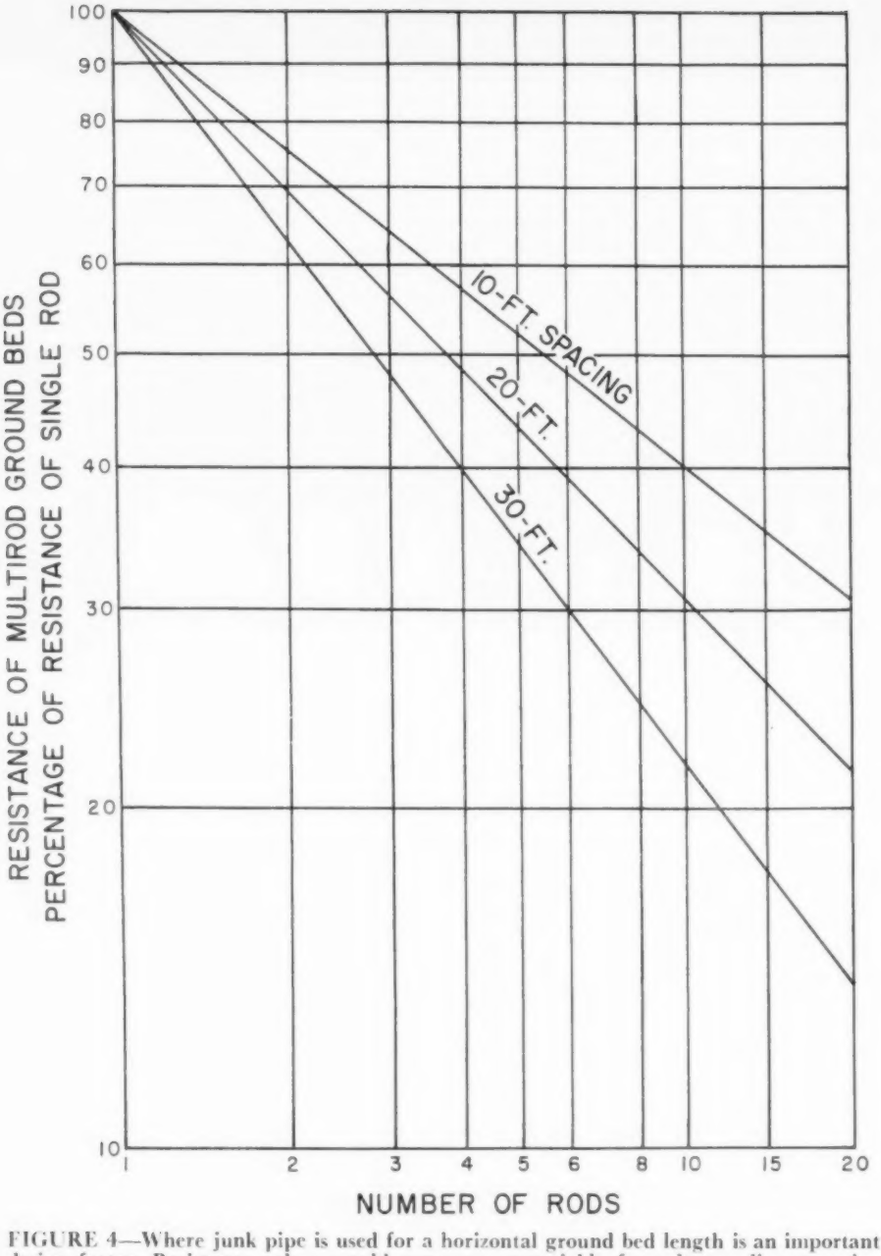


FIGURE 4—Where junk pipe is used for a horizontal ground bed length is an important design factor. Resistance values would not vary appreciably for a larger diameter pipe of comparable length.

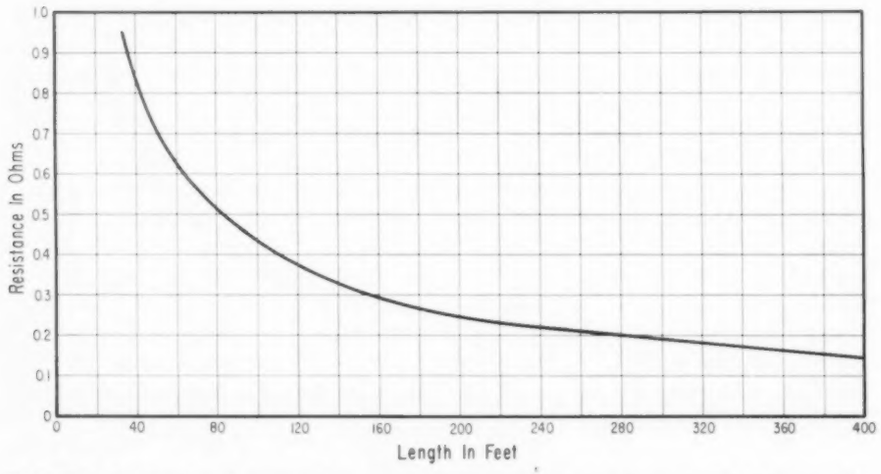


FIGURE 3—Spacing has an effect on overall ground bed resistance. Resistance of the multi-rod bed is shown in terms of the resistance of a single rod.

higher the pipe-to-soil voltage, the greater will be the current entering the pipe at this point. For this reason, a close ground bed will not distribute current as well as a more remote one. The minimum distance suggested by some corrosion engineers is 400 to 500 feet.

Rod Requirements. The number and size of rods is governed largely by the amount of current required. Often, however, in order to get resistance down to a reasonable figure, more rods are used than are required by current demands. Recommended current densities for graphite rods are in these ranges: 2-inch by 80-inch—3.15 amperes; 3-inch by 80-inch—5.25 amperes; 3-inch by 60-inch—4.0 amperes; and 4-inch by 80-inch—7.0 amperes. Published tables indicate that silicon iron rods may be used for even higher current density.

Resistance of a single rod may be determined from Figure 2. A straight line drawn from a specified anode size to a known average soil resistivity on the vertical line will give the proper anode to ground resistance in ohms. Note that this is the resistance of a single rod in tamped coke breeze backfill three rod diameters in diameter.

After determining the resistance of a single rod, Figure 3 can be used to determine what the resistance of a multi-rod bed would be in terms of resistance of a single rod.

Spacing Calculations. If the area is not limited by right-of-way considerations or a high resistivity soil, it is usually wise to extend the ground bed so that the current load per rod will be below its normal rating. This will reduce the over-all resistance and thus reduce power consumption.

Effect of spacing on over-all ground bed resistance may also be observed from Figure 3. Keep in mind during rod number and spacing calculations that cost of cable and right-of-way enters the picture, too.

Junk Metal Beds. If the selected ground bed site does not have low resistivity soil to a depth suitable for a vertical ground bed, it may be desirable to use junk pipe or other junk metal available. However, the price of scrap may govern the choice of this material.

The approximate life of a ground bed constructed of junk steel pipe can be calculated on the basis of 20 pounds

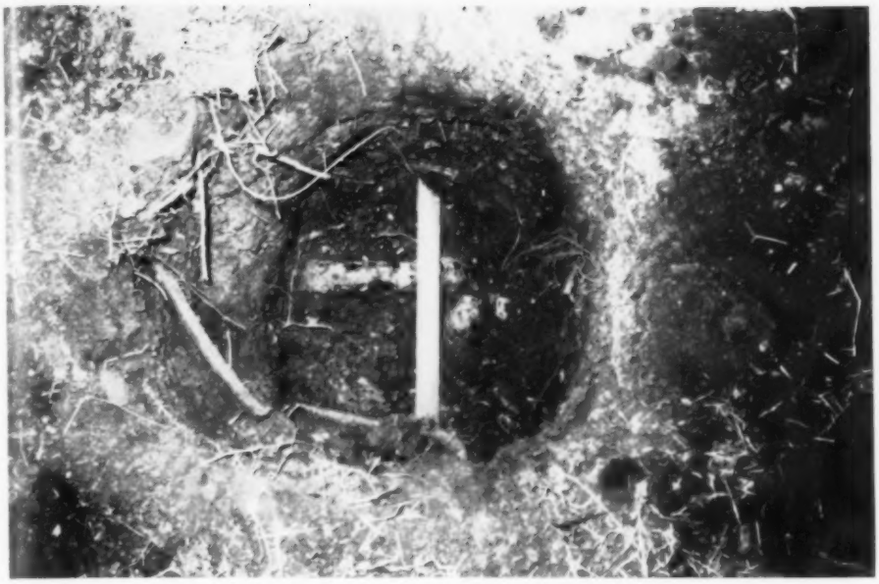


FIGURE 5—Accidental contacts with foreign structures are troubles to watch for both during construction and maintenance. Here a water line has "shorted" to a gas main causing an extra load on the cathodic protection system.

metal loss per ampere-year. This is based upon virtually 100 percent electrolytic efficiency. Efficiency percentage will drop off over a long period of use.

Resistance of a 6-inch pipe, 3 feet deep in 1,000 ohm centimeter soil is shown in Figure 4. There is a sharp decline in the first part of the curve. Since resistance varies much more with length than with diameter, the values derived from this curve do not vary greatly with pipe diameter. For instance, resistance of a 12-inch pipe, 200 feet long would be about 0.22 ohms; that of a six-inch pipe of the same length would be 0.25 ohms. Differences become even less with greater lengths of pipe.

To assure continuity of a junk metal bed over a long period, it is a good practice to coat a narrow strip along the top of the pipe. Also, it is well to bring a heavy riser to the top of the ground and attach the positive lead to it above ground.

Provide for Gas Venting. With the horizontal ground bed, gas locking is no problem. However, when using the deep vertical bed, provision should be made to vent each rod. Coarse gravel encased in 6-inch stove pipe has proven suitable for this purpose.

Preventing Accidental Contacts. The term "grounding," although it might be correct, is not commonly used by pipeliners for accidental contacts. They are frequently referred to as "shorts." Whatever term is used, they remain one of the corrosion engineer's chief headaches, especially in congested areas such as large municipalities.

After having established that a coated pipe line has been protected to a pre-determined protection criteria, a system of monitoring the protection should be installed. Permanent installations, using indicating pipe-to-soil meters, are very often profitable. Otherwise, periodic readings should be observed with a portable voltmeter of proper design.

Low Pipe-to-Soil Means Trouble. If the pipe-to-soil potential is found to be too low, the anode is trying to handle a larger pipe area than it is capable of protecting, either because the coating has been damaged considerably or the line has come in contact with a foreign structure. A technician can easily determine if the trouble is due to damaged coating by inserting a small dry cell battery (a flashlight battery is usually large enough) and an ammeter into the anode circuit. If protection cannot be restored with a small amount of current, the line is very likely in contact with a bare system.

Assuming that the line is "grounded," the next step is to locate the contact. Figure 5 is a picture of a water line service "shorted" to a coated gas main.

Locating the Contact. An audio-frequency pipe locator may be used to locate almost any type of contact. This instrument transmits an audio signal, most of which follows the path of least resistance; this signal is picked up by a receiver.

Should a line contact a gas main at a crossing, the point of contact can be located by connecting the locator across the lines. Most of the signal transmitted will travel to the point of contact on one line and return on the other. This will result in a drop in the signal at the point of contact distinguishable in the receiver.

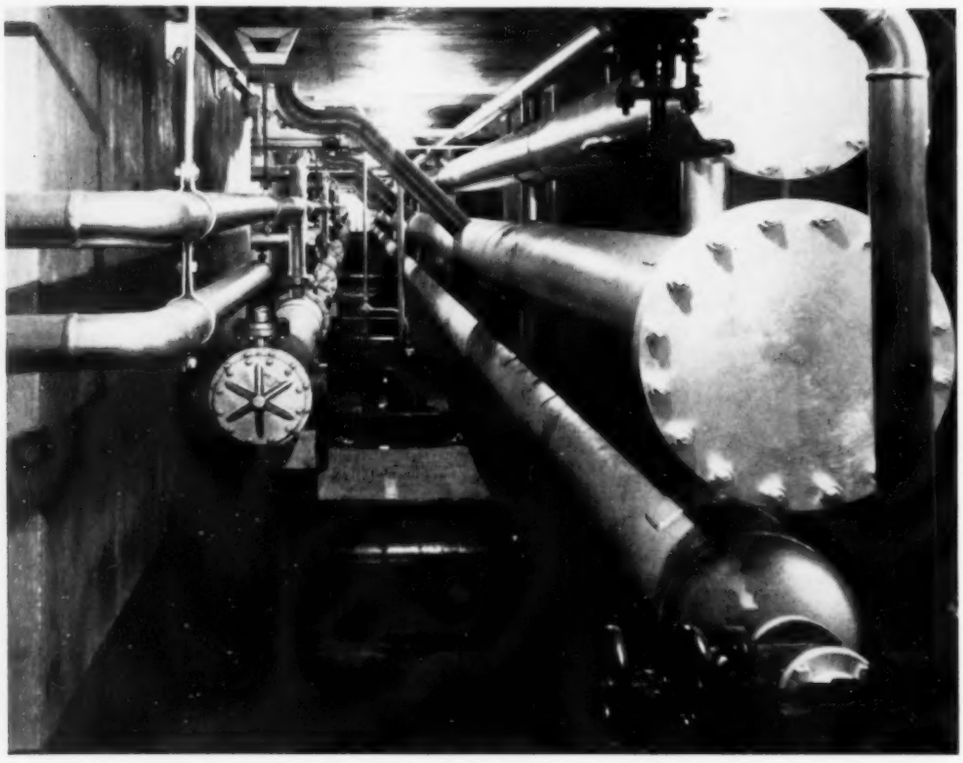
Another method of locating this type of contact is to connect a battery (a car battery is sufficient) in such a manner that the current will surge through the line briefly. A compass laying on the pipe will indicate current passing under it by a deflection of the compass needle. When the compass is placed on the pipe beyond the point of contact, there will be no needle deflection. A compass that will not hang when placed near metal should be used for this test.

When an audio signal is transmitted to a pipe line that is interrupted electrically with an insulating connection, the signal will show a decrease at the point of insulation unless the insulation has failed. If the insulating connection happens to be in low resistivity soil, the signal drop will be hard to distinguish as the soil will provide a shunting resistance low enough to permit the signal to by-pass the point of insulation. In this situation, the pipe locator may be connected in the anode circuit using the anode as a ground.

—**The End**

About the Author

O. W. Everett, cathodic protection supervisor, Oklahoma Natural Gas Company, has been active in corrosion control work for nine years. An active member of the NACE, he served as chairman of the Tulsa Section's Pipeliners Corrosion Short Course. Everett studied engineering at Oklahoma State University before joining Oklahoma Natural. He is a member of several engineering societies and the Tulsa Engineers Club.



Concrete floors in the basement of stations are subject to moisture, sweating, jacket water and lube oil leaks. Coating with polyamid epoxy coatings will give extended service life. Basement piping, subject to similar conditions may be treated in the same manner.

A Guide For Better Station Painting Programs

Proper planning and materials insure long life from station painting. Stations will look better and give longer maintenance free service.

By R. M. Ives, Jr.
Sales Technical Service Division
Humble Oil & Refining Company, Houston

FREQUENTLY in the process of new contruction activity, questions pertaining to painting programs and surface corrosion problems are virtually forgotten. The result of such an approach is an insufficient, unsupervised paint system applied more or less as an afterthought in order to achieve an initial "dress-up" of the property. The same thinking is often evident under maintenance painting operations where a finish coat is applied to old paint, dirt, and rust without an effort to clean and prepare the surface properly.

Such approaches to the painting problem are examples of false economy; especially in the case of new construction programs. Never again will there be such an excellent chance to study painting requirements, and to schedule a complete program free of all previous mistakes and malpractices.

New Construction Painting Specifications. Prior to actual construction, complete specifications for the paint program must be prepared and printed. These specifications should be written and controlled by the corrosion engineer, with assistance from the general engineering groups and the coating supplier's technical service representatives.

Surface Preparation. Experience obtained from Gulf Coast construction strongly points out the need for excellent surface preparation and paint systems on all metals destined for extended service in corrosive areas. Without such preparation, the surfaces will show premature aggressive failure due to atmospheric corrosion.

In the case of metal surfaces, the use of utility type shop primers is definitely not recommended. Structural members, vessels, and other fabrications that have received a shop primer generally exhibit the following qualities when delivered to the job site:

- Minimum or no surface preparation.
- Low film build of primer, <1.0 mil.
- Premature rusting due to thin film, presence of holidays.
- Brittleness of primer.
- Chalking or oxidation of primer pigments.

Due to these common characteristics of a shop coat, it is much more desirable to specify in contracts and orders that a shop primer not be applied. The steel should be shipped to the job site bare, and, immediately upon arrival, sandblasted to bright metal and given a full field coat of a quality primer.

In the case of machined and finished areas, they should be coated with a suitable, long durability, rust preventive at the time of manufacture.

Actual recommendations for job site surface preparation to metal, masonry, and wooden surfaces are shown in Table 1. It should be reemphasized that all specifications regarding the desired surface preparation show clearly and specifically on the general painting specifications for the job. Unless this is accomplished, neither the paint contractor, the general contractor, nor the owner's representatives will be in a position to accept and enforce the specifications during painting.

Recommended Paint Systems. Just as it is important to obtain the best possible surface preparation, so it is to obtain the most desirable painting system. The term "most desirable" is used when considering the paint system since factors of material availability, surface preparation, operating conditions, application problems and economics will all have a bearing on selection of the coating system.

Conventional, industrial quality, primers and finishes can be found to offer optimum performance for most station painting needs. These will usually include all interior structural equipment painting, together with general exterior piping and building requirements. Some special applications such as hot surfaces and cooling tower installations, etc., will, however, require newer more specialized coatings that have been developed for a specific service.

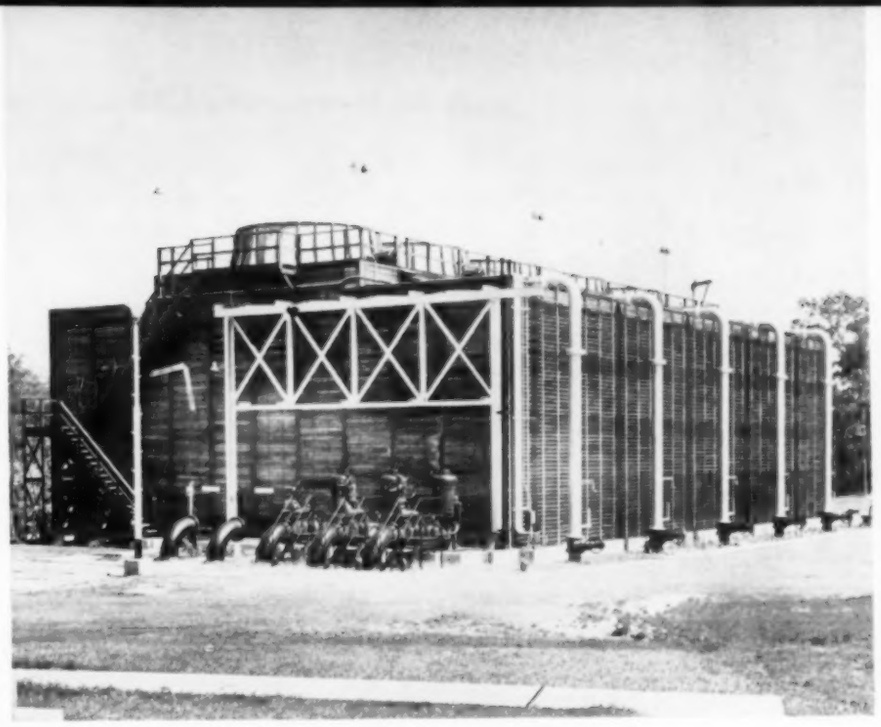
In all cases a multi-coat paint system is recommended. Such a procedure offers a number of distinct advantages in the finished system:

- Sufficient film thickness.
- Freedom from pinholes and holidays.
- Intermediate inspection work.
- Utilization of specialized pigments and resins for rust inhibition, color retention, gloss, etc.

Table 2 shows recommended painting systems for station painting requirements.

Application Suggestions. Painting specifications should specifically set forth the manner in which all coatings are to be applied. Any deviation from those procedures should be only with permission of the corrosion engineering group, since many paints are recommended for a particular method of application in order to satisfy a specific need. An example of this would be the brushing of a first coat primer in order to better wet and work the coating into the metal surface. If such a primer was rapidly applied by a spray method, the possibility of holidays, "dry" spots, and gaps might be materially increased.

Paints should never be thinned without approval of the manufacturer's technical representative; nor should coatings be applied past their intended coverage rate per gallon. Spray type application should be such that a full, wet paint film is delivered to the surface to be painted. Overspray should be controlled closely through regulation of air requirements and spray gun motions. Brush or roller applications should be utilized where their ability to carry and work heavy materials on a surface is advantageous. This is frequently found in primer type coatings.



Thick film, multi-coat applications of epoxy coatings offer most effective means of protecting headers, risers and metal structures of cooling towers. Application should be made to well cleaned dry surface. Asphalt mastic in conjunction with polar type preservatives and aluminum sealers offer an economical "in operation" application.

Inspection Considerations. By far the most variable and inconsistent consideration connected with a painting program is that of inspection. This is dangerous because only by frequent and detailed inspection is it possible to reliably evaluate the quality of material and the manner in which it is applied.

It cannot be emphasized too strongly that a continuing inspection program is the best means to over-all job control; and the only method to observe and rectify errors when they occur.

Responsibility for the paint inspection program is twofold for all practical purposes. Insofar as the owner is concerned, direct responsibility lies with the corrosion engineer. However, coating manufacturer's technical man can be used to supplement the inspection schedule.

Frequently the inspection work and general field contacts with construction personnel are offered by the industrial coating manufacturer as a service feature accompanying the purchase of their products.

Attention should be directed toward the establishment of a planned inspection program that will cover all aspects of the painting activity. The corrosion engineer, construction people, paint contractor, and the

TABLE 1—Recommended Job-Site Surface Preparation

Surface	Preparation Desired	References and Remarks
Ferrous Metals	Bright metal sandblast	Steel Structures Painting Council: SP-5-52T White Metal Blast Cleaning.
Non-Ferrous Metals incl. Galvanized	Solvent cleaning and hand cleaning	Steel Structures Painting Council: SP-1-52T Solvent Cleaning and SP-2-52T Hand Cleaning.
Masonry	Clean, dry, roughened surface, free of old paint, oil and other foreign material	U. S. Dept. of the Interior, Bureau of Reclamation, Paint Manual 1953, Chapter IV, Sec. B, pp. 140-142. Hand and mechanical cleaning satisfactory. Light sandblasting or acid etching provides roughening treatment. In general, it is not advisable to paint concrete sooner than three weeks after completion.
Wood: a. Interior	Dirt, dust and oil free; hand sanding	U. S. Dept. of the Interior, Bureau of Reclamation, Paint Manual 1953, Chapter II, Sec. B, pp. 27-29. Stoddard solvent acceptable to clean oil and grease from surface to be painted.
b. Exterior	Dirt, dust and oil free; hand brushing and scraping	Same as interior.

TABLE 2—Recommended Paint Schedules

SURFACE TO BE PAINTED	PAINT SCHEDULE				
	Prime Coat	Second Coat	Third Coat	Fourth Coat	Remarks
1. General Service: A. Ferrous Metals—Exterior	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Modified phenolic varnish aluminum coating	Modified phenolic varnish aluminum coating	See Notes 1 and 2.
B. Ferrous Metals—Interior	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Long to medium oil alkyd resin enamel with appropriate color pigments	Long to medium oil alkyd resin enamel with appropriate color pigments	Second coat primer optional depending on service conditions.
C. Galvanized Metal	Drying oil type primer with TiO_2 and cement pigments	Selected aluminum or enamel finish as per 1-A or B above	Selected aluminum or enamel finish as per 1-A or B above		Primer is single compartment ready to apply material.
D. Non-Ferrous Metals—Exterior	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Modified phenolic varnish aluminum coating	Modified phenolic varnish aluminum coating	See Note 3.
E. Non-Ferrous Metals—Interior	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Long oil alkyd resin, drying oil extended—zinc chromate and iron oxide pigmented	Long to medium oil alkyd resin enamel with appropriate color pigments	Long to medium oil alkyd resin enamel with appropriate color pigments	See Note 3.
F. Masonry Surfaces—Under heavy traffic and abrasion service	Epoxy, polyamid type primer	Epoxy, polyamid type finish	Epoxy, polyamid type finish		Includes such surface as: station floors and engine and pump blocks. See Note 4.
G. Masonry Surfaces—Not under heavy traffic and abrasion service	Polyvinyl Acetate Emulsion type coating	Polyvinyl Acetate Emulsion type coating	Polyvinyl Acetate Emulsion type coating (third coat optional)		Includes such surfaces as: asbestos cement brick, sheetrock, plaster and concrete walls.
H. Wood—Exterior	Linseed oil type TiO_2 pigmented outside paint	Linseed oil type TiO_2 pigmented outside paint			Fume and mildew resistant properties required.
I. Wood—Interior	Alkyd resin type undercoater or PVA coatings	Alkyd resin type enamel or PVA coatings	Alkyd resin type enamel or PVA coatings		
2. Special Service: A. Hot Surfaces: 1. Less Than 400° F	Processed Oil Based metallic zinc pigmented	Processed Oil Based metallic zinc pigmented			Conventional primers and finishes good up to 180° F.
2. Above 400° F	Silicone resin, metallic zinc pigmented	Silicone resin, metallic zinc pigmented			Silicone type coatings require curing temperatures of 400° F for 1 hour.
B. Cooling Towers					Open types—forced or induced draft.
1. Tower out of operation—sandblasted surfaces	Epoxy, polyamid type primer	Epoxy, polyamid type intermediate coat	Epoxy, polyamid type finish coat	Epoxy, polyamid type finish coat	Apply to 10 mils min., pinhole free.
2. Tower in service—hand cleaned surfaces	Polar type preservative compound	Asphalt mastic coating $\frac{1}{8}$" thick	Alkyd resin enamel or varnish aluminum type sealer coat		Applicable to external piping only. See Note 5.

Notes:

1. Additional drying oil added to alkyd primer improves wetting properties. Zinc chromate offers rust inhibiting qualities while iron oxide provides improved hiding properties. Coating dries in 6-8 hours.

2. Phenolic resin, tung oil type varnish offers excellent durability for general purposes industrial finish. For maximum service life, $2\frac{1}{2}$ pounds of aluminum paste (325 mesh) are recommended.

3. Non-ferrous metals, including aluminum, brass and copper, as commonly found in station painting programs, represent only minor surface areas. To facilitate simplified priming procedures, the standard alkyd resin based, zinc chromate type primer may be successfully used to paint non-ferrous metal surfaces.

4. Epoxy coatings, when used in exterior service, tend to exhibit chalking tendencies. This is not considered harmful to the over-all coating life. Polyamid type epoxies exhibit better chalk resistance than the amine cured or ester type epoxy formulations.

5. Sealing coats of aluminum or enamels should be applied over mastic compounds after allowing ample time for solvent release, 1-3 weeks. All coating should be done when wind conditions offer a relatively dry side of tower.

coating manufacturer's representative all should jointly plan and follow the program.

Suggested times for inspections are:

1. **Pre-Construction**—to inspect site, contractor's equipment, coating material stocks, and to meet field personnel.
2. **During Primer Coat Application**—at least once during application of primer in order to observe surface preparation, and general application techniques of painters.
3. **During Finish Coat Application**—at least once during finish coat application to observe accumulated film thickness and general application technique.
4. **Final—After Completion**—over-all quality of job, final film thickness, final remedial actions.
5. **Special Applications**—to assist in application of special materials or investigate specific problems related to application techniques, product quality, etc.

Whenever an inspection of the painting program is conducted, written comments should be prepared on the specific items involved, then should be forwarded to the construction supervisors and to the company representatives responsible for the construction. At all times an endeavor should be made to review as many aspects of the painting as possible. With each inspection, special points will want to be stressed; however, in general the following points should be checked on every inspection trip:

- Surface Preparation.
- Application Techniques of the Painters.
- Wet Film Quality of the Coating.
- Dry Film Quality of the Coating.
- Holidays, Runs, and Sags in Coatings.
- Individual and Accumulated Film Thickness.

With the final inspection report, the new construction phase of a painting program is completed. If all has been planned and executed as within the scope of this paper, a better initial coating system has been established, and the over-all painting program is now ready to be considered from the maintenance standpoint. Final inspection reports should be preserved and used in conjunction with maintenance reports. The only way to properly evaluate a coating

system is to have all information available.

Pre-Construction Planning Necessary. Prior to actual construction work, many problems relative to the painting program must be considered and resolved. To properly institute and maintain a balanced painting program study, many people or groups are involved. Primary responsibility will lie with the company's engineering group, especially with the corrosion control section. Also involved will be the contractor or applicator, and the technical service engineers of the coating manufacturer.

Proper coordination of the activities of these three groups will eliminate many problems that might otherwise arise during the actual job. Initial discussions between the corrosion engineer and the coating manufacturer's representative will resolve important items, such as the most desirable means of preparing the surface, the proper coatings to be used, and similar problems.

Maintenance of Existing Stations and Systems. Certainly it is desirable to establish a maintenance painting program immediately following new construction. Even though the best possible coating job is obtained, unless it is properly maintained and touched up in time it will have to be replaced. With proper inspection and "touch-up" a good job will last indefinitely.

Survey of Existing Procedures. The first step in the development of a maintenance type program is to realistically survey existing paint systems and corrosion control methods. On the site evaluation of company properties will show some practices and ideas of value that may be turned into an organized program.

All existing reports on corrosion problems, control methods, coating surveys, and specifications should be collected and reviewed. These should be utilized wherever possible to contribute to the preparation of a complete painting specification similar to that used for new construction work. All phases of surface preparation, application methods, and coating schedules must be considered.

The Maintenance System. In general a maintenance system will utilize lesser degrees of surface preparation due to smaller surface areas involved. This is not meant to imply that any less thorough practices should be accepted. Hand and mechanical spot cleaning will be required in many instances. When this is so, every effort should be made to completely remove scale, corrosion products, and other foreign matter so that a clean, bare metal surface is present.

Application methods will be largely by brush, however, occasional spray painting will be necessary. Practices of good workmanship should also be demanded under maintenance conditions.

Coating materials acceptable for a maintenance painting system need not differ from those recommended for initial construction. It is desirable to incorporate the complete multicoat initial painting schedule into the standard company specifications. In that way the first coat primers and the final finish coats are already designated and may be extracted for maintenance requirements as needed. Table 2 is adaptable for maintenance service under these conditions.

Selection of Personnel. One very important point regarding selection of maintenance painting personnel needs to be stressed. That is, in order to obtain maximum return from man hours invested, men should be assigned to painting as a regular, preferably full time job. If painting is performed by personnel drawn from miscellaneous classifications on a stopgap basis, the over-all quality of the maintenance program, its equipment, material, and application techniques all will suffer.

Personnel Instruction. Instruction of personnel is also necessary in the development and operation af a maintenance painting program. Suggested points to develop in such instruction:

- Necessity of proper surface preparation.
- The need for good material.
- Necessity of proper application.
- The need for continual maintenance.

The last point regarding continual maintenance is the most important. If the idea can be sold to the plant personnel involved, the problem is half solved. When people believe in a project or program, their best efforts will be freely directed toward the goals set forth in that program.

Need for Continuing Inspection. One final point remains to be discussed in regard to the maintenance painting program. As with new construction programs, the need for inspection is paramount. With maintenance programs, however, this practice must be continuing. A definite schedule should be established to thoroughly inspect all properties; results of which should be recorded and acted upon promptly. Usually the company corrosion engineer or his representative will conduct these inspections.

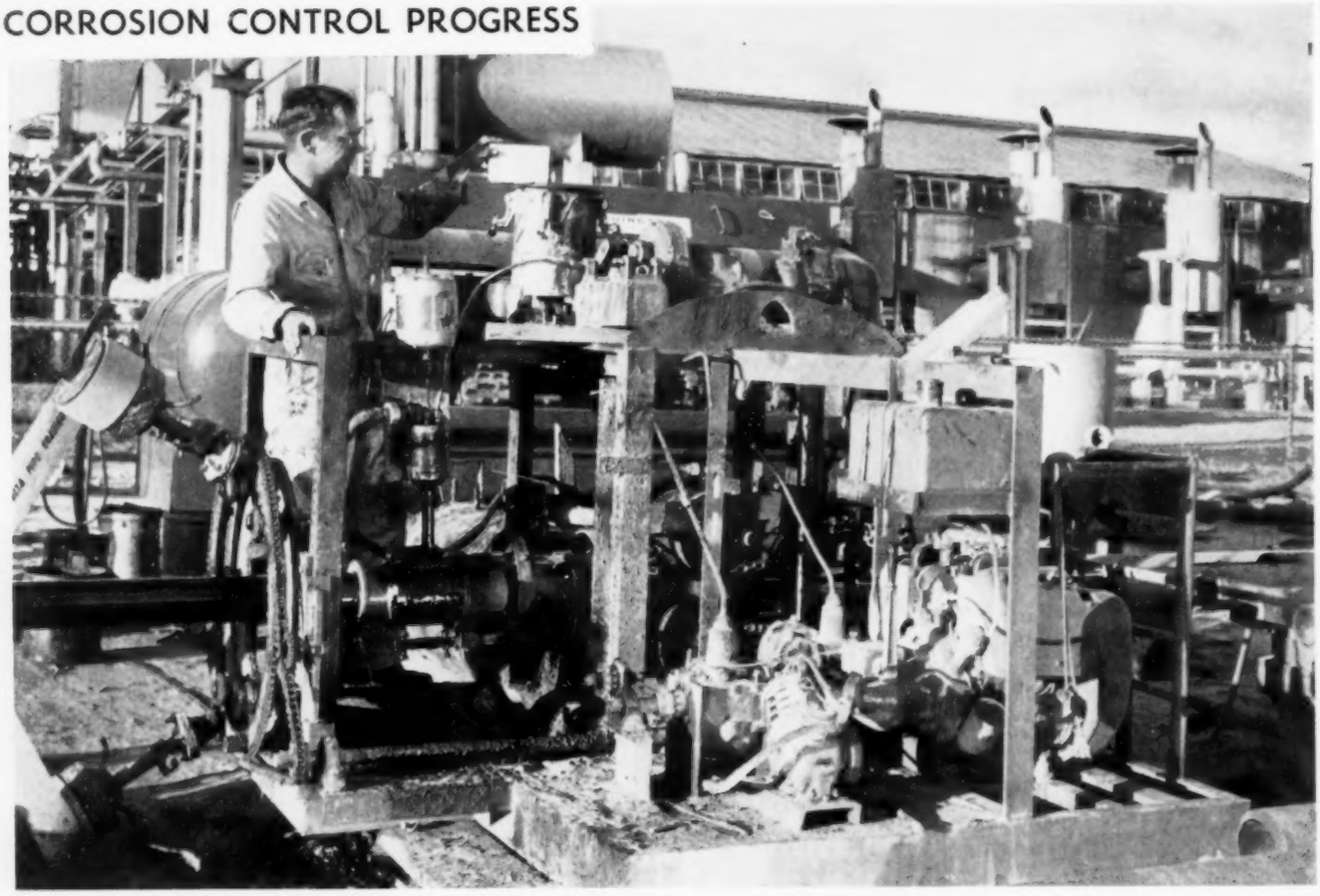
Lower Corrosion Costs Result. To obtain a more effective station painting program, one must first study and plan the objectives; these will include surface preparation, application, and coating specifications. Planning should be utilized both in new construction and maintenance programs to provide a smoothly functioning operation.

Inspection of all work, both new and maintenance, is the best means of insuring a well prepared surface and properly applied coating system. For maintenance use, this inspection program should be continuing, with the objective of finding and repairing small corrosion break-throughs at once.

If these basic procedures are followed, together with the use of quality materials and competent technical service assistance, an improved, smoothly functioning painting program will result. —**The End**

About the Author

Robert M. Ives, Jr., is a senior technical service engineer with Humble Oil & Refining Company, Sales department, Houston. He was graduated from Baylor University, Waco, Texas, in 1950, with a B.S. degree in chemistry. Upon graduation he was employed in the Humble Special Products Manufacturing division as a development chemist, working on protective coatings. Since 1953, Ives has been a member of the Humble Sales Technical Service division, where his primary responsibilities have dealt with protective coatings and corrosion problems in the pipe line and gas transmission industries. He is a member of the Houston Section of the National Association of Corrosion Engineers.



Pipe line cleaning and priming machine is adapted for application of coal tar-epoxy coating. Revision included proportioning equipment and a mixing head for continuous blending of the two components of the coating. From the mixing head, coating is fed to the coating shoe which extrudes it around the pipe. Continuous mixing prevents waste of material.

New Machine for Thin Film Coatings

Revised pipe line priming machine applies coal tar-epoxy coating. Metered coating components are blended and fed directly to coating shoe.

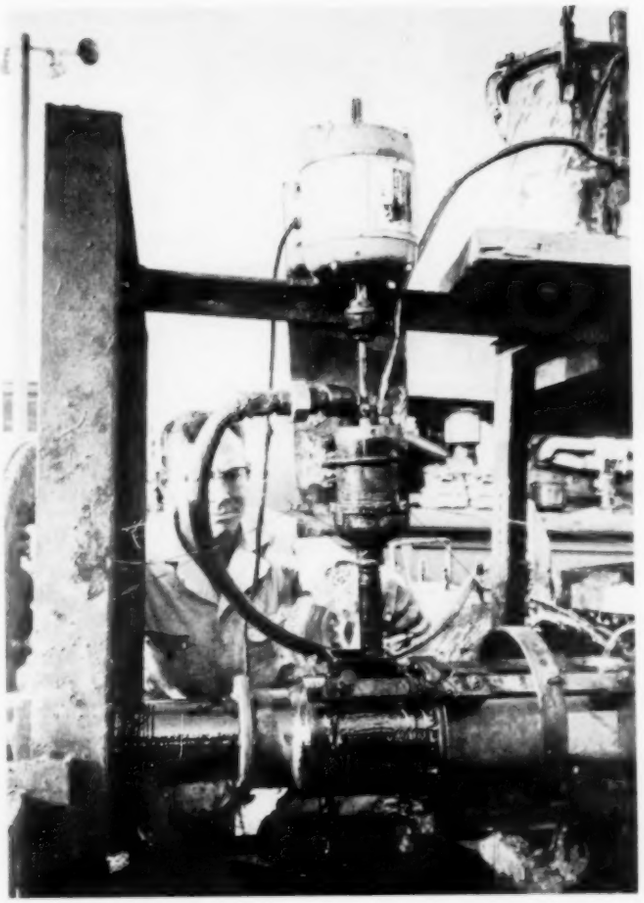
By N. T. Shideler
Pittsburgh Coke and Chemical Company, Pittsburgh, Penn.

INCREASING INTEREST in thin film coatings for external protection of pipe lines has raised application problems. Until recently these materials were applied by spray gun. Although a satisfactory coating could be applied in this manner, overspray resulted in waste of a large amount of the material, as well as the equipment being bulky and adjustment of fluid pressures critical.

Use of materials which have to be converted, such as the coal tar-epoxies, complicated the situation. Since the pot life is limited, only a small amount of the coating could be mixed at a time. To overcome these problems, a standard pipe line priming machine was converted to meet the requirements of this material.

The equipment was developed jointly by Tulsa Pipe Coating, Inc., and the Protective Coating division of Pittsburgh Coke & Chemical Company. Pittsburgh had previously developed proportioning equipment and a mixing-head for proper blending of the two components continuously.

Gas System Reconditioned. Shell Oil Company operates a series of gas injection lines serving a number of wells around their cycling station at Elk City, Okla. Lines ranging in size from 4- to 8-inch nominal diameter of extra heavy wall steel pipe were installed bare and placed in service early in 1951. By the middle of 1955, external corrosion was causing failure in "hot spots." After replacement of several short sections of the pipe, it was decided that approximately 35,000 feet of these pipe lines should be



The two components of the coating were metered in proper proportions into mixing head and the mixed coating fed into coating shoe. Uniform 25-mil thickness was spread around the pipe.

Kraft paper is spirally wrapped over coating as it leaves the machine. Ends of the joint were taped to prevent their being coated. Field joints were hand coated with the same material.

reconditioned and coated to protect the pipe, prevent further leaks, and reduce cathodic protection costs.

Coal Tar-Epoxy Selected. In selecting a coating for these high pressure lines the high temperature of the gas had to be considered. The gas enters the 8-inch sections of line at approximately 230° F., and even at the well head the average temperature is 210° F. Most coatings used for external protection are not recommended over 190° F.

Several coatings were considered and tested. On the basis of these tests a coal tar-epoxy coating was selected. This coating when cured is tough, has excellent bond to steel, yet is sufficiently flexible to permit bending of the pipe without damage to the coating or loss of bond. A standard test performed by the manufacturers is to apply the coating approximately 20 mils thick to a thin 2½-inch by 6-inch steel plate. After thorough setting, the coating is tested by bending the plate through a 360-degree bend over a ½-inch mandrel. Excellent bending quality is indicated by a 4-inch pipe that was sandblasted, coated with 20 mils of the coating and bent at approximately 40° F. with no loss of bond, checking or cracking.

Coating Has Required Properties. The cured coating becomes harder at elevated temperatures and is safe for continuous uses at 300° F. High electrical resistance, excellent resistance to moisture, soil acids and alkalies, and resistance to usual soil contaminants are exhibited by the coating. Although these coatings are comparatively new and do not have long service records, their field applications to date, laboratory test data, and the known performance of both the coal tar and epoxy resin coatings indicate good performance from their combination.

The coal tar-epoxy system of coatings consists of a viscous thixotropic material shipped as one unit and a catalyst or converter shipped in a separate container. Since the pot life of the combined coating is relatively short, it must be used within a period of approximately one hour after mixing. The converted coating may be applied by brush, spray, or flow coating. After application, the coating hardens or sets partially due to evaporation of a small amount of solvent but mainly due to the chemical reaction which takes place between the two components. Since this reaction is affected by heat, coating applied to pipe sets much faster at higher temperatures.

Coating Applied by Spray Gun. Reconditioning of approximately 35,000 feet of 4- to 8-inch pipe was completed during 1956. The pipe was sandblasted then coated with a spray coat of coal tar-epoxy coating into which glass fabric was spirally wrapped, followed by a second spray coat of the coating. Thickness of the coating in this application was approximately 40 mils.

Converted Machine Used on New Connection. After completion of the reconditioning, a new injection line consisting of approximately 8,800 feet of 3- and 4-inch schedule 160 pipe in

Ends of the pipe are supported on skids until the coating has hardened. From that point on the pipe was handled much the same as bare pipe.

Flexibility of the coal tar-epoxy is demonstrated by the bend in this 4-inch joint of pipe. After sandblasting, the pipe was coated with 20 mils of the coating and bent at approximately 40° F. with no loss of bond, checking or cracking.

40-foot double random lengths was coated with the coal tar-epoxy coating. In this application, completed in November, 1957, the converted coating equipment was used.

Using this equipment, the pipe was cleaned by sandblasting and passed through the priming machine to which was attached the automatic mixing-head. The two components of the coal tar-epoxy coating were metered in proper proportions into the mixing-head and the mixed coating fed into a coating shoe around the pipe. As the pipe passed through this shoe, a uniform thickness of coating was spread around the pipe: average thickness 25 mils. As the pipe passed out of the machine, it was spirally wrapped with kraft paper.

After the pipe left the coating machine, it was transferred to the drying rack where it was supported at each end until the coating had dried. From that point on the pipe was handled much the same as if it were bare pipe. The ends of the pipe were masked with tape to prevent their being coated and to allow for welding in the field. Field joints were coated with the same material by hand. After allowing sufficient time for the field joint to harden, the coated pipe was lowered in. All coating was electrically inspected before installation.

Although this equipment was crude and will require refinement and modification, it is indicated that equipment of this type can be used for the rapid application of coal tar-epoxy coating to pipe of all sizes. The equipment is capable of handling at least 1,800 feet of pipe per hour.

Film Thickness Reduced. Indications are that the 40-mil coating on the reconditioned pipe was heavier than is necessary for protection of underground pipe lines. Consequently, in the use of the machine for application of the coating to new pipe, coating thickness was approximately 25 mils. Even with grit or sandblasting the maximum anchor pattern is not more than 5 mils; thus a 25-mil coating has at least 20 mils coating thickness over the peaks of the anchor pattern.

The extreme stability of the coating, excellent bond, resistance to moisture, and high electrical resistance indicates that it should protect the pipe for many years. Cathodic protection requirements should be reduced since there was little damage to the coating during installation. Subsequent damage by either soil stress or rock penetration should also be slight.

—The End

About the Author

N. T. Shideler is technical advisor in the Protective Coating division of Pittsburgh Coke and Chemical Company. He had previously served as manager of the Protective Coating division before being elected president of Insul-Mastic division. He received a B.A. degree in chemistry from Indiana University in 1926. Since 1930 he has been associated with several companies, all dealing with coal tar coatings. He joined Pittsburgh Coke and Chemical Company in 1948, starting their production of coal tar coatings.

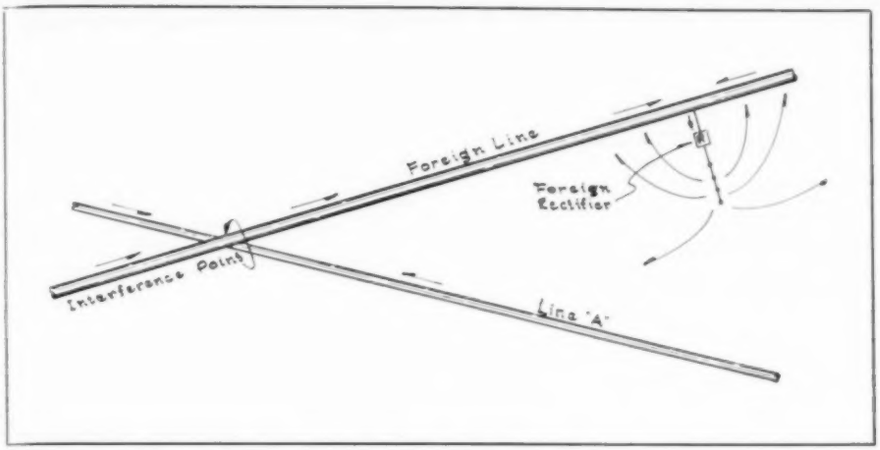


FIGURE 1—Interference between pipe lines is a serious cause of corrosion. Current from a foreign rectifier can be picked up by unprotected line. This current is usually discharged at crossing, causing corrosion at that point.

Coordinating Operations and Corrosion Control

Close cooperation between engineering and operating groups saves money and simplifies maintenance problems.

By W. A. Hutchison
Sinclair Pipe Line Company, Independence, Kans.

INEVITABLY in any corrosion control program a great segment of the company will be affected by even a small job, making coordination in planning and execution of real importance. Close cooperation among everyone affected will become increasingly more important as the complexity of the operation increases.

There are several ways in which better coordination can be accomplished between operating personnel and the corrosion engineering group of the company. Generally speaking, the job of the corrosion engineer is to stop and to prevent active corrosion on the pipe line system in the most economical way. Without complete cooperation between corrosion engineering and operating groups, corrosion mitigation will be seriously handicapped.

Consider Corrosion Before Construction. If the corrosion engineer participates in the planning stage of all projects, he can go over the proposed route and make special effort to locate foreign rectifiers, D. C. railways, contaminated soils and other specific hazards. With this information he can recommend slight changes in routing to avoid these hazards; he can recommend insulating flanges to isolate D. C. railways and he can recommend proper coating specifications. If the line must go through contaminated soils, this should be considered in coating and cathodic protection specifications.

If the line is to go through residential areas, the coating should be very good because of the possibilities of interference with other lines, especially utilities. When the line is to go into a metropolitan area, a check should be made to see if there is a coordinating committee on corrosion. If such a committee is functioning, valuable information can be obtained from it concerning problems which likely will arise, plus a drawing showing all of the underground piping in the area.

Reconditioning Jobs Require Individual Study. The corrosion engineer should also be consulted when planning for reconditioning work, as these jobs usually occur in contaminated areas and in most cases need to be treated individually. To make proper recommendations, he needs to know what is involved. This includes the type of soil, the condition of the pipe (was it ever coated or were magnesium anodes ever used), and in addition, can the line be shut down and for how long? Some companies believe that if at least a half mile of pipe is to be reconditioned and coated, it can be more economically protected if insulating flanges are installed at each end of the area. This, of course, would be true only if the line could be shut down and drained without too great expense or if the line is to be cut anyway.

Follow-up Necessary. Good planning means nothing if it isn't followed up with proper inspection or supervision. With a new project, this can start with the initial survey where it is very important that the notes include such things as previously mentioned, that is, foreign lines and rectifiers, D. C. railways and anything else that is unusual or not immediately apparent to the eye.

With this information, it is possible to avoid, in some instances, a very serious cause of corrosion—interference between pipe lines (see Figure 1). Of course, pipe lines have to cross railroads and foreign piping, but these, if known in advance, can be taken care of without additional expense.

Good Inspection Vital. During construction, good inspection is needed to insure a well bonded coating with

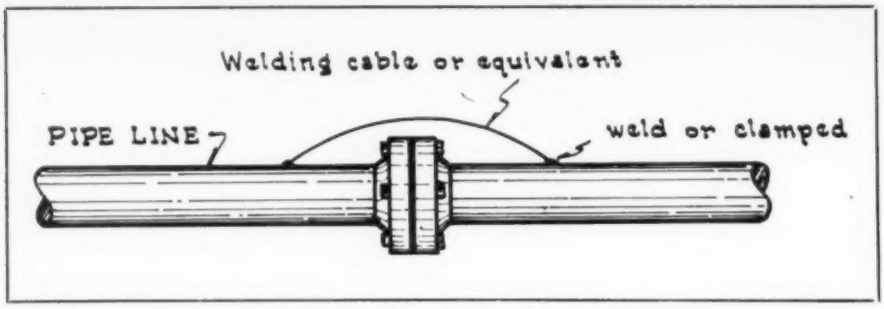


FIGURE 2—Precautions should be taken when parting a line carrying volatile products. Most lines carry several amperes of direct current which will spark when the circuit is broken. A bonding cable installed across a flange or place to be cut will avoid the possibility of a spark.

a minimum of damage during lowering-in and backfill operations. Insulators should be properly installed on pipe through casings to prevent shorted casings. If one becomes shorted, the amount of bare pipe connected to the system in comparison with the "holidays" in the coated pipe is tremendous, and takes a lot of extra current just for these casings. It is good practice to put a cradle as near the end as possible in order to keep the pipe off the casing during settling of the backfill. Precautions should be taken to prevent shorting test leads attached to the pipe with leads on the casing.

Corrosion Program Must Be Sold. Probably the point where corrosion engineers really fall short and cause the greatest stumbling block to coordination is in the field of education. They often fail to put across in an understandable way the real benefits of corrosion control so that management as well as the field man, will be more willing to assist in the corrosion control program. They do not take the necessary time to explain the causes of corrosion and how to mitigate it.

When a line is 100 percent cathodically protected it is imperative that field men are informed and realize the importance of not disturbing the line in any manner without first consulting the corrosion engineer. Many lines that are protected will have several insulating flanges which electrically isolate it from all connecting structures.

Any time a tie-in is made to this line, the tie-in, too should be insulated. Great care should be taken when working around an insulating flange, and all work should be reported so the line can be checked to see if it is still properly insulated.

Work With Safety Department. When a line carrying volatile material is to be cut or a flange is to be parted, care must be exercised to prevent sparking. Most lines carry several amperes of D. C. current which will cause a spark when separated. Bare lines in some parts of the country do not carry enough current, but a possible danger, nevertheless, exists. On coated lines, or on any protected by rectifiers, or in stray current areas, the current can be quite large, especially near the unit or drain point. A heavy bonding cable, as shown in Figure 2, should be connected to both sides of the flange or place to be cut before the work is commenced. If the location is near a rectifier the current should be turned off.

Instructions to the field should be clear, and where possible an attempt should be made to explain why the work is to be done. As an example of what can happen when the reason for a job is not understood, a gang was told to install test leads every mile on a section of line. They installed one every 5,280 feet, not taking into consideration whether it was a convenient location or not. If they had understood the purpose of the leads, and the fact that the distance between leads was not critical, this situation would not have arisen.

Complete Records Needed. Many of the corrosion engineer's recommendations are partly based on the past history of a line as shown on records, making it important that records be complete. When a leak is reported, the cause and exact location must be shown. Many field men have either guessed or paced the distance a leak was from a tag and then had trouble finding the saddle when they went back later to make permanent repairs. It is difficult to locate anodes in leak areas where measurements have been haphazard.

A very important item to consider when repairing a leak is to determine what caused the leak. Just noting the leak was a pit is not enough. It should be determined if there is a foreign line parallel to or crossing the line in the vicinity, and if so how much clearance there is between the lines. A close check should also be made to determine if a rectifier is on the foreign line within a mile of the crossing. This becomes more of a problem each year as the number of rectifiers in use increases. Reconditioning work should also be described accurately, as this influences the decision as to how the line may best be protected. It is good practice to show foreign lines and rectifiers on the maps where your own are shown.

Cooperation Key to Coordination. Before decisions concerning maintenance or new construction are made the corrosion engineer should be consulted. After the pipe is in the ground it is too late to coat it, to change its route, or to protect it without substantial additional expenditures.

Proper communication between various departments of the company will go a long way toward making a corrosion control program successful. Free discussion between operating personnel and staff men can be helpful to both. The corrosion engineer can learn a lot about the system and problems involved, through meetings with field men, provided the field man understands what the corrosion engineer is doing. —**The End**

About the Author

Wm. A. Hutchison, senior electrical engineer for Sinclair Pipe Line Company, Independence, Kansas, has been engaged in corrosion work since joining Sinclair in 1949. He holds a B.S. degree in electrical engineering from Oklahoma State University and is a member of NACE. Hutchison directs the corrosion control program in the Mid-Continent area.

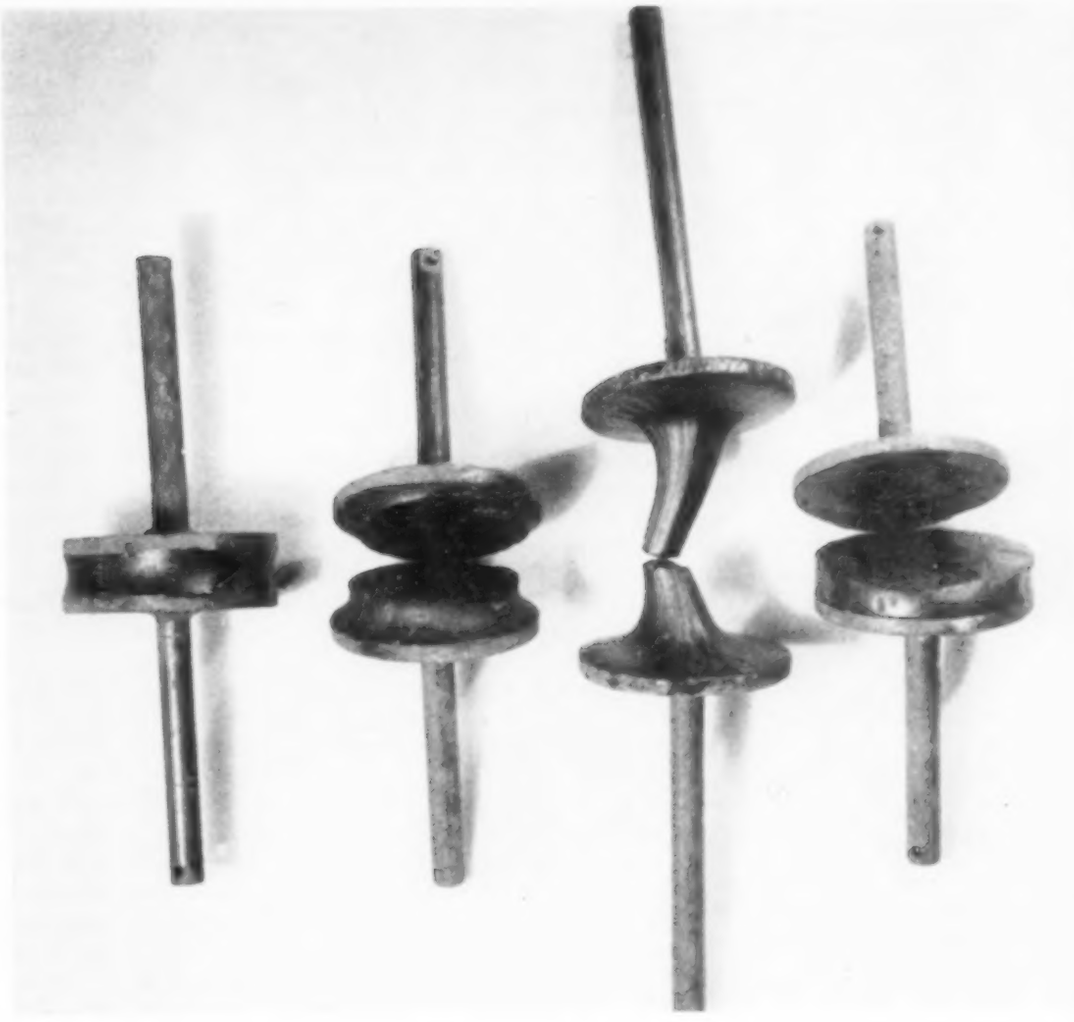


FIGURE 1—A practical evaluation of the adhesion, cohesion, and bonding properties of an asphalt enamel is shown graphically in tests on these bonded disc specimens from which 50-pound weights were suspended for periods up to a year. The specimen at left shows good adhesion, cohesion and resistance to stress and thermal shock; appearance at the end of the test is almost identical to that at the start. Good adhesion, but slightly lower cohesive properties were shown by the second specimen; the third set of discs indicate how a coating with good bonding and adhesion but poor cohesive properties elongates and pulls apart under stresses that cause plastic flow. The specimen on the right was of a test enamel with satisfactory cohesion but with poor adhesion and bonding properties.

What Makes a Good Asphalt Coating?

Tests evaluated in the light of experience help to bridge the gap between laboratory research and good field performance.

By Lloyd F. Bramble
President, Gulf States Asphalt Company, Incorporated, Houston

TODAY'S MEANING of the word "asphalt" as a noun or an adjective is often only vaguely understood. An asphalt technician developing a good pipe line coating can supply enough of a definition to fill a book.

Briefly, asphalt is the residue of certain types of petroleum after evaporation or distillation of other volatile components, either naturally or in a refinery. Those bitumens resulting from natural aging are called "native asphalts"; residues produced by refining, "asphalt bitumens." An asphalt bitumen which has been treated by the use of air under suitable conditions is called a "blown asphalt."

There are gaps in our knowledge of the chemical structures and compositions of asphalts, but there is a wealth of information on their physical properties and field performance. In any asphalt considered for a pipe line enamel a critical evaluation of these characteristics has to be made:

- Cohesion and adhesion. Effect of surface tension, interfacial tension, density and permeability.
- Mechanical strength including coefficient of expansion, resistance to stress, vibration, shatter and cold flow.
- Thermal stability under expected range of operating conditions.

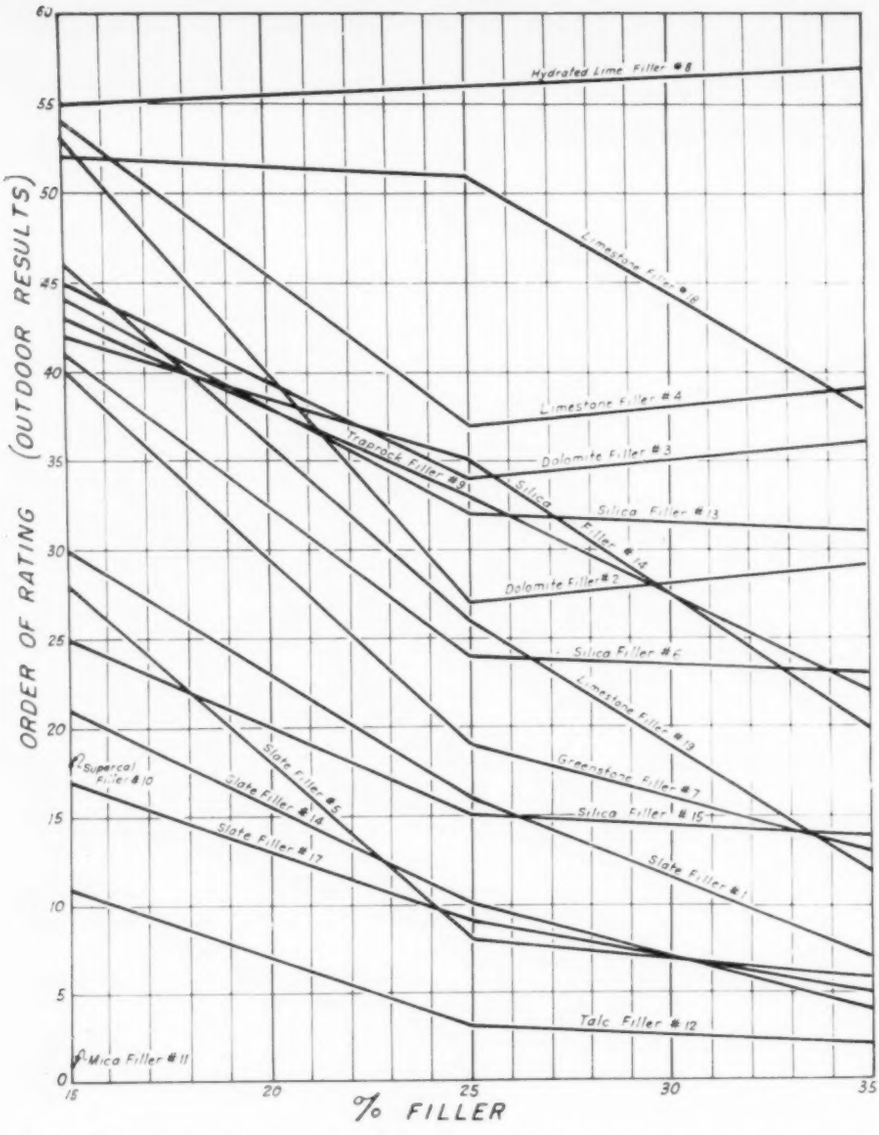


FIGURE 2—National Bureau of Standards tests emphasize, graphically, the importance of selecting the proper filler for an asphalt pipe line enamel. The lower numerical rating, the higher the performance of the filler material. Identical basic asphalt was used for all tests.

- Dielectric strength and any losses with time.
- Chemical properties.
- Stability under storage conditions.

With properly chosen basic materials, properly formulated and checked with both laboratory tests and field performance records, enamels have been developed with a good record on all of these tests.

One of the properties that should be avoided in selection of a basic asphalt is the presence of migrating oils in the specimen. With such a material the oils will exude and capillary action results in transfer of the oil to the adjacent soil. The remaining asphalt film hardens slowly to the degree that fissures develop; ultimately reaching to the metal beneath.

Importance of Stability. Other characteristics of a coating are meaningless if it lacks stability over a period of many years. The simple act of melting a pipe line coating and maintaining it at field operating temperature can throw an unstable product off specification.

Modern, acceptable asphalt enamels are very stable bitumens. They do not give off fumes or vapor when heated; do not undergo partial distillation; and can be safely maintained at temperatures far in excess of those normally encountered during construction operations without any real damage to the coating. As a matter of fact, a "dope" kettle of today's asphalt pipe line enamel can be ignited and allowed to burn without damaging the remaining material to the degree where it would be necessary to discard it. This "stability plus" under working field conditions amounts to extra insurance of a good coating job.

Stability of the finished asphalt enamel is achieved through precise quality control during selection of the basic asphalt, selection of admixes, formulation and blending.

Laboratory determinations of water solubility or absorption must be made upon "stabilized" asphalts to be meaningful. Asphalt undergoes a period of transition before reaching stabilization. During this time changes occur that could be reflected in the weight differentials interpreted as moisture adsorption or solubility.

For example, certain types of California residuals have a high quantity of migratory waxes that cause them to be an exceptionally effective waterproofing and protective material after they have reached stabilization.

Effect of Mechanical Stresses. There are a variety of causes for mechanical stresses that may cause coating failure—including backfilling, lineal expansion, distortion under heat, varying moisture content of the soil, soil heave or other physical strain. To meet these conditions, the good pipe coating must remain bonded to the pipe, retain flexibility for years, must not flow at high pipe or soil temperatures, nor develop brittleness.

Few pipe line engineers realize how the trend to big inch pipe has changed the physical demands on the pipe line enamel. "In the ditch" protection for a small line is altogether different from the protection requirements for a 30 or 36-inch gas transmission line. Interior and exterior stresses to which the $\frac{3}{16}$-inch application on a 6-inch pipe line would be significantly different from that on a 36-inch.

On the larger line the enamel thickness must not only afford all of the protective characteristics necessary on the small line but it must also withstand the additional three dimensional stresses to which it will be subjected. To do this it must not only be tough and resistant to soil stresses, but must also exhibit a high degree of flexibility over a wide temperature range.

Soil stresses by themselves cause enough difficulties. Coupled with thermal shocks, thermal strains, differences of coefficient of expansion between metal and enamel, bending

moment of the pipe in handling, circumferential expansion by internal pressure or temperature changes, lineal elongation from temperature changes or other stresses, it can become a real problem for the coatings engineer.

Proper formulation of the enamel must afford the correct elasticity and flexibility without the tendency to develop internal strains within the film thickness of the enamel itself. Thus the enamel provides for the proper equilibrium of three dimensional stresses and the subsequent relaxation that is a necessity within the structure of the enamel. Resistance to impact and ability to absorb vibration is truly a property that is essential in top quality enamels. To resist impact the enamel must stand up under shear stress, plain stress, pressure stress and all of the stresses resulting from elongation, pressures or temperature changes.

Test of Enamel Strength. Many measurements have been devised to determine the effect of these forces. Enamels undergo critical tests for cracking, disbonding, deflection, high temperature sag, peeling, impact and penetration on every batch produced. Studies have been made of surface forces such as pressure of one body upon another or hydrostatic forces, gravitational forces, body forces, shearing stresses, temperature shocks, elongation under load, resistance to impact and various other tests to correlate coating properties with ditch conditions.

Practical Strength Test. One readily reproducible test has been used in the laboratory to predict the bonding and cohesive characteristics of an asphalt enamel. It is set up by cutting two circular discs three inches in diameter. By means of a mold, hot pipe enamel is poured between the two discs providing a solid layer ½ inch in thickness that bonds the two discs together. The specimen is then suspended carrying the load of a 50-pound weight under tension and left on test under normal ambient conditions for a one-year cycle.

More failures are observed from temperature changes than from any other cause, as one might expect. In certain seasons of the years the temperature may fall as much as 50 degrees within a relatively short period; during these rapid variations stress conditions are most severe on the enamel block.

Visual inspection of test specimens after separation provides a practical evaluation of enamel properties. Flexibility may be judged by elongation of the sample; adhesion can be evaluated by the type of fracture whether within the material or at the metal interface. This test gives an indication of the coating's ability to withstand soil stress in the ditch.

Proper Use of Primers. Pipe coating with new asphalt enamels can be done under virtually any temperature conditions where crews can work. Priming operation requires a certain flexibility. Today's asphalt primers bond to the enamel even under slightly dewy conditions. This eliminates having to follow the prime coat immediately with an enamel coat. As a matter of fact, a period of a few days may elapse between priming and coating. A product which "deadens out" is not only an inconvenience, it often reveals a fundamental weakness of the primer.

When primer and enamel are of related materials, the desired state of bond stability is reached in the minimum time. Mismatching of primer and enamel requires a longer period of time, during which certain adhesive values may be lost.

Today's high quality primers have high adhesive properties. A recent laboratory tensiometer test showed that an unprimed surface required a force of 625 pounds before a stripping occured. Priming the same surface increased the adhesion to a value exceeding cohesion. About 80 percent more tension was required, the break at 1,100 pounds was within the enamel itself.

Water Absorption Tests. Much has been said of the water absorption by asphalt. Actually there is very little likelihood of significant water absorption or permeability with a modern, properly formulated asphalt pipe line enamel.

There are three ways that water could be taken up by asphalt. One is by normal solubility of water in the material itself. This is a negligible quantity, that is practically immeasurable by objective laboratory tests by qualified technicians. Here it should be said that any water absorption test where weight loss or gain is considered should be critical of outside influences that might give the wrong conclusions. For example, a non-toxic asphalt enamel will often pick up a coating of algae while submerged in water, and, if weighted with this deposit, the specimen could show completely misleading results.

Also, there are many different compositions of basic asphalt. If there were water soluble salts present, these could possibly increase the water content in the asphalt. In practice, this is very unlikely because salt bearing residuals are not selected for the formulation of pipe line enamels. In modern refinery practice, crudes (whether high in soluble salts or having salts in negligible quantities) are desalted prior to processing.

A third possibility of water absorption could be from an improper selection of the filler used. This is a problem in ethics as well as technical judgment. Finely divided amorphous fillers used in the formulation of the enamels are selected not only for their qualities of decreasing plastic flow and brittleness but also for their low water absorption properties. Many tests of moisture absorption in the pipe line enamel are actually evaluations of the filler's water take-up. In the formulation of any pipe line enamel the best insurance of correct selection of extenders and fillers is the experience and reputation of the manufacturer.

—The End

About the Author

Lloyd F. Bramble, president of Gulf States Asphalt Co., Houston, has been active in asphalt technology for more than 30 years. He studied engineering at LaSalle University and the University of Pittsburgh. Bramble has been active in the National Association of Corrosion Engineers and in technical committee work since organization of his company in 1947. His professional activity includes memberships also in American Chemical Society, National Paint Manufacturer's Association, Paint and Varnish Production Clubs, and Houston Engineering and Scientific Society.

FIGURE 1—Ideal terrain for pipe line installation. Pipe must be coated because of seasonal variations in soil resistivity.

Aramco Looks at Its Coating Program

Low cost, local availability and generally acceptable properties indicate asphalt coatings most economical for Arabian pipe lines.

By V. M. Liss and Paul Fetko
Arabian American Oil Company
New York City

WITH SEVERAL years of field experience as a basis, Arabian American Oil Company has made a critical re-evaluation of its corrosion control program. A comparison of properties of various coating materials, their costs, and record of performance sheds some light on the optimum economic relationship between the cost of protective coatings and cathodic protection under the special conditions Aramco met.

Aramco has constructed in Saudi Arabia more than 600 miles of buried pipe lines which pass through sandy and rock terrain as well as through moist salt flats. Soil resistivity in the area varies all the way from 2,000 to 180,000 ohm centimeters.

To protect these lines from corrosion, Aramco had used an asphalt coat and wrap system; ready availability of this coating material from the company's Ras Tanura refinery was a prime consideration at time of construction. However, since there are many other factors in coating selection besides initial material cost, other available coatings were investigated to determine whether the asphalt system should be continued.

Variety of Systems Tested. Coatings considered in the study were double-coat, double-wrap systems using coal tar and asphalt enamels,

FIGURE 2—Rocky terrain such as this demands maximum physical strength from a coating system.

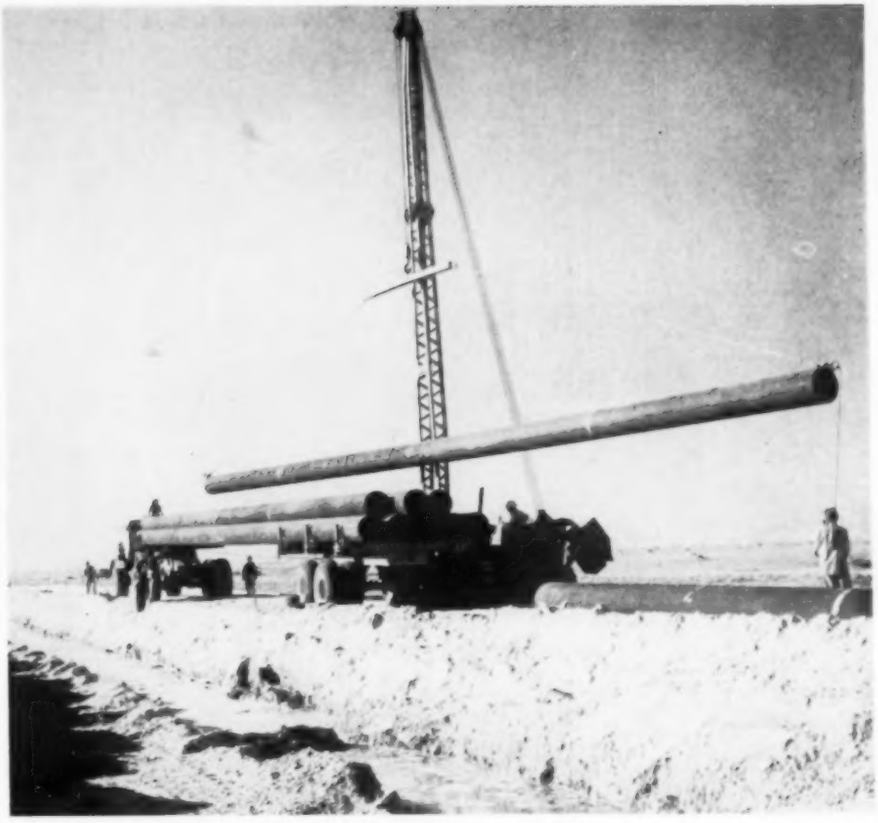


FIGURE 3—Near the Persian Gulf coast, in salt water saturated areas known locally as "Sabkhahs," corrosion is severe. Complete protection of pipe line systems is imperative.

plastic tapes, and asphalt mastics. The physical properties of the asphalt mastics are very attractive, but because application would require setting up an expensive plant, no actual field tests are planned. If sufficient pipe were to be coated and a suitable mastic could be made under local conditions using Saudi Arabian sand, mastic coatings would become more competitive with asphalt enamel systems.

In view of the increasing use of plastic tapes for pipe line service, Aramco plans to test wrap approximately 28,000 feet of 14-inch transfer line with polyethylene tape to determine its performance under Arabian service conditions. The remaining half of this line will be a double-coat double-wrap asphalt system for comparison purposes.

Cost of Coatings. In developing complete installation costs for double-coat double-wrap coatings, Figure 4 was plotted to indicate the U. S. and Arabian cost for coal tar enamel and asphalt enamel coatings. These costs are based on prices and required quantities of primer, asphalt, felt, and fiber glass materials as shown in Table 1. Application costs for Saudi Arabia were based on U. S. material requirements. In the analysis, an estimate of unit operations and man-

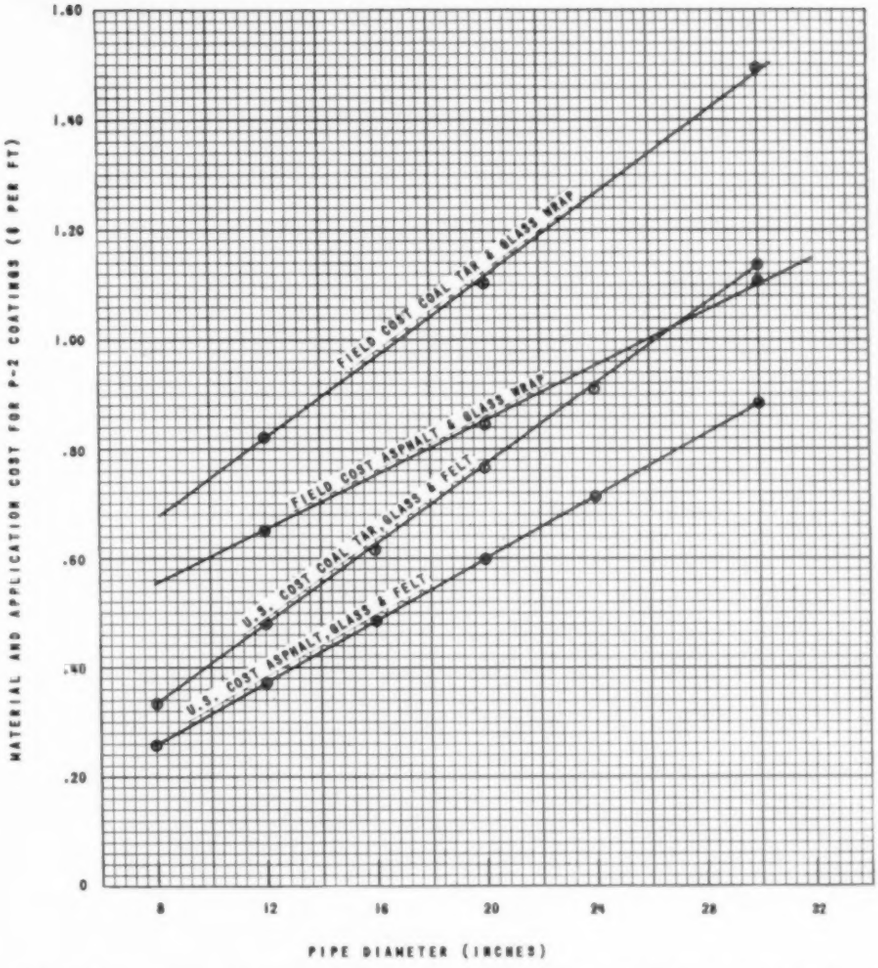


FIGURE 4—Comparative cost of double-coat double-wrap coating systems in the U. S. and Arabia.

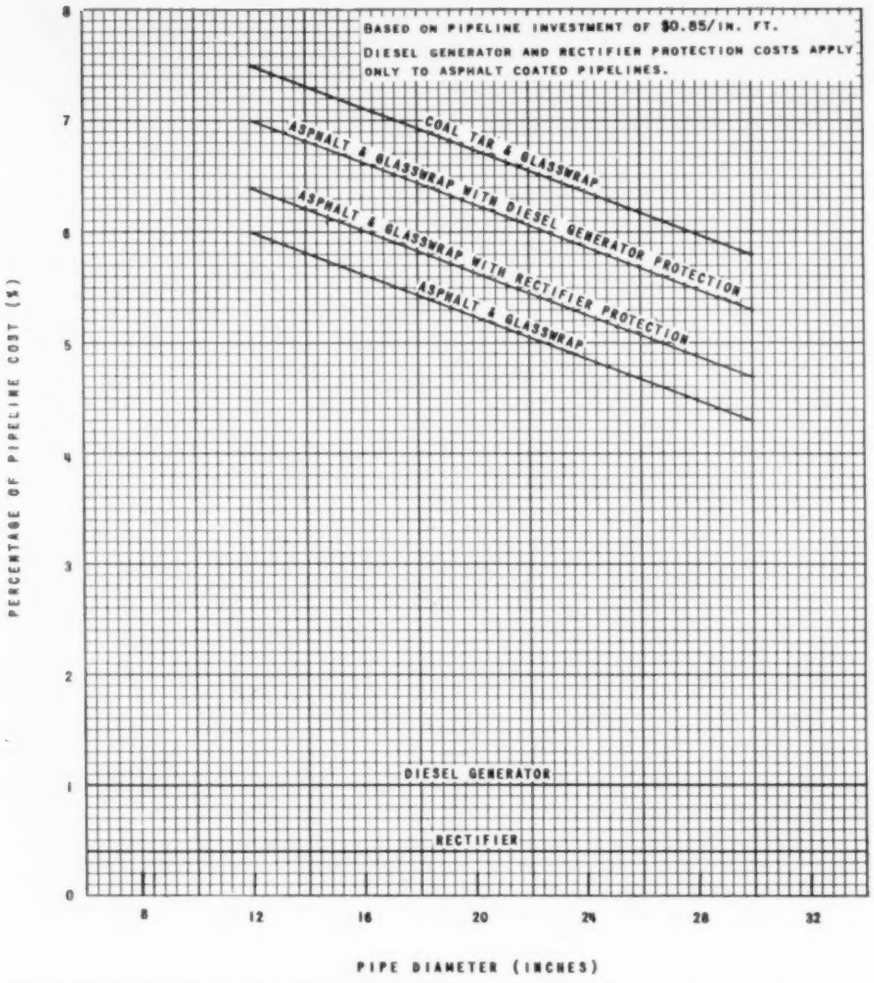


FIGURE 5—Coating and cathodic protection costs in percent of pipe investment, based on investment cost of 85 cents/inch-foot. Diesel generator and rectifier protection costs applied here only to asphalt coated pipe lines.

power requirements for double-coat double-wrap application was made for specific lengths of various sizes of pipe lines. The Arabian unit costs for applying asphalt and coal tar on 12-, 20-, and 30-inch pipe lines also include administration and general expenses.

The resulting cost of asphalt and coal tar coatings based on a percentage of total pipe line investment for various sizes of pipe line is shown in Figure 5. With the cost taken at 85 cents per inch-foot, Figure 5 shows that the lines coated with Arabian manufactured asphalt are cheaper than those coated with an imported coal tar. Also shown are the costs of diesel generators and rectifiers for 100 percent protection of asphalt coated pipe lines in Arabia. It is interesting to note that an asphalt coated pipe line with 100 percent cathodic protection is cheaper to install than a coal tar coated line with no cathodic protection.

It was estimated that the Arabian application cost of polyethylene tape with a protective outer wrap would be slightly less than a conventional asphalt coating for a 14-inch line. The high U. S. material cost ($7.45 per square based on an order of 10,000 squares) is offset by lower labor and equipment requirements. It has already been established by Aramco's engineers in Arabia that plastic tapes are economically suited for short sections of small diameter utility lines.

TABLE 1—Single Coat-Double Wrap Coating Information*

O.D. PIPE SIZE (In.)	MATERIAL REQUIRED PER MILE FOR JOBS LESS THAN 15 MILES				COATING COSTS (DOLLARS)						
	Primer (Gal.)	Modified Enamel (Ton)	Wrap (Sq.)	White-wash (Gal.)	A-2 Material (Per Mile)	A-2 Material (Per Lin. Ft.)	Equipment and Labor Application (Per Lin. Ft.)	TOTAL COST (PER LIN. FT.) A-2	A-1	B-2	B-1
$8^5/_8$	22	4.5	136	24	672.16	.127	.155	.282	.255	.286	.262
$12^3/_4$	32.5	6.5	195	35	928.40	.176	.220	.396	.370	.411	.376
20	51	10	301	55	1,490.00	.282	.352	.634	.580	.642	.589
24	61	12	361	66	1,791.00	.340	.436	.776	.710	.786	.716
30	76	15	446	83	2,225.25	.421	.530	.951	.870	.965	.884

JUNE 1, 1954 MATERIAL PRICES F.O.B. HOUSTON

$1.565/Sq.	15 Lb. Felt
.16/Sq.	60 Lb. Kraft
1.11/Gal.	Primer
.95/Sq.	Glass
.10/Gal.	Whitewash
67.40/Ton	Enamel

COATING MATERIAL CODE

A-2 Enamel, Glass, Felt, and Whitewash
A-1 Enamel, Felt, and Whitewash
B-2 Enamel, Felt, Kraft, and Glass
B-1 Enamel, Felt, and Glass

* For double coat-double wrap, add extra enamel coat where required.

Cost of Cathodic Protection. An analysis, based on cathodic protection semi-annual reports, was made for long sections of buried asphalt-coated pipe lines. A 30-31-inch Qatif-Qaisumah (QQ) line was made the main basis of power requirement investigation because it is a long, buried line with many cathodic protection units and many years of service. A 22-inch Qatif-Ras Tanura (QRT3) and a new 30-32-inch Qatif-Abqaiq (QA-3) line were also used as sources of information. The current, voltage, and operating time of the cathodic protection units were used to determine the expended wattage. Wattage per square foot of pipe area was then plotted against years of service. Figure 6, the resulting plot, is felt to be somewhat inconclusive because of the limited data available, but it does show a general trend toward increased power requirements with time.

Generator and Rectifier Costs. A power requirement of 0.0028 watts per square foot was used to determine the diesel generator and rectifier cost for an asphalt-coated line. Thus, the diesel generator and rectifier capital

ost percentages of total pipe line investments as shown in Figure 5 are based on installations of sufficient cathodic protection to satisfy the requirements of the fifth year after installation and not merely the initial requirements. In developing the cathodic protection costs for the QQ line, the unit installation cost was determined to be $30,000 for a diesel generator with anodes and cables, and $12,000 for a rectifier of similar output.

An analysis of the cost of maintaining a remote diesel generator or rectifier set was made for a 30-31-inch line. In general, the annual cost was approximately half the cost of the capital investment of the generator set. The cost of operating a rectifier was practically nil. Attempts were made to develop similar information for coal tar enamel coatings, but there was insufficient data on initial cathodic protection requirements or on increased requirements with age.

Soil Resistance Generally High. There are only a few areas along the Arabian "QQ" pipe line where the soil resistance is less than 5,000 ohm/cm. However, there is a large seasonal change in soil resistivity. In addition, variations in soil resistivity between adjacent areas contribute to corrosion of the lines. There is no question on Aramco's part that Arabian pipe lines should be coated.

Protection Requirements for Tape. Cathodic protection requirements for polyethylene tape wrapped pipe lines are claimed to be one-third the requirements for asphalt. A published article on cathodic protection requirements of tape[1] describes tests made to verify the low current requirements of taped pipe lines.

Operating Cost of Coated Pipe. Factors which will undoubtedly enter into payout calculations for comparing coatings are the maintenance and leak history for various types of coating. A review of operating costs indicated that such a breakdown is not available for Aramco's asphalt-coated pipe.

Experience of other companies has shown that maintenance costs of a 100 percent cathodically protected line are negligible. The only variations between coating types would be the added cathodic protection costs of a poorly coated line.

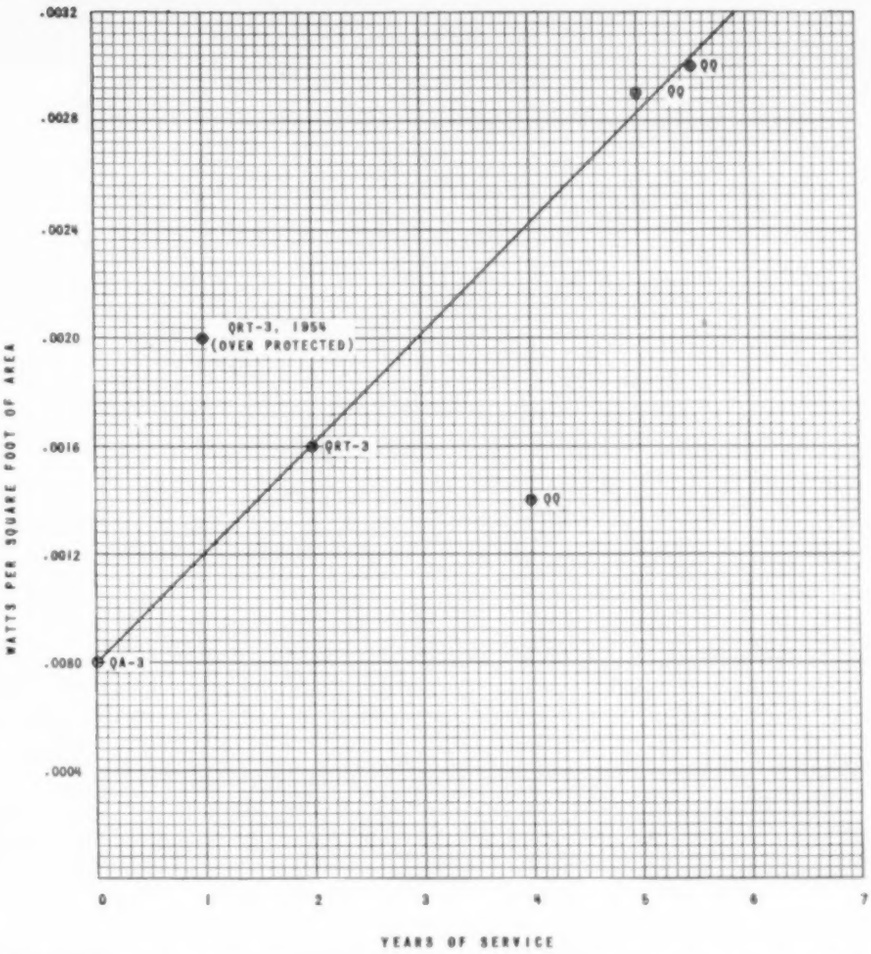


FIGURE 6—Power requirements of three asphalt coated lines in Aramco's system. Data is insufficient to draw definite conclusions, but a general trend towards increased power requirements with time is indicated.

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[1] Parker, Marshall E. "How About Plastic Tape Coating?" *Gas Age*, Nov. 18, 1954, pp. 31-33 and "Plastic Tape Tests Show Low Current Needs," PIPE LINE INDUSTRY, Aug. 1956, pp. 44-45.

Liss

Fetko

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Paul Fetko, a 1955 graduate of the U. S. Military Academy, holds a BS degree in military engineering. As an engineer in the Technical Services division of the Arabian American Oil Company in New York, he has been active in pipe line corrosion studies.

Fetko is currently on leave of absence, studying at the Harvard Graduate School of Business Administration.

How Sharp is Your Income Tax IQ?

Check it with these questions—knowing the answers can save you money when you file your personal return.

TEST YOUR knowledge of the federal income tax law with this quiz prepared by the American Institute of Certified Public Accountants in cooperation with the Internal Revenue Service. You will find the correct answers on Page 64.

1. *When you were transferred to another city, your company gave you a sum of money toward the cost of moving you and your family. For tax purposes you should consider this money as ....*

(a) A gift that is not taxable

(b) Income that is subject to tax with a deduction for only your personal moving expenses

(c) Income that is subject to tax with a deduction for the cost of moving your entire family

2. *You have invested in several blue-chip stocks. The dividends received from this investment are exempt up to ....*

(a) $50 whether you or your wife owns the stock

(b) $100 if the stock is held jointly by you and your wife

(c) $100 regardless of who owns the stock, providing you file a joint return with your wife

3. *You are not permitted to deduct as contributions your donations to which of the following organizations ....*

(a) Charitable societies

(b) Educational institutions

(c) Political parties

4. *Your daughter, who was hospitalized for several weeks in the earlier part of 1957, was married in November. If she files a joint return with her husband, you may ....*

(a) Not claim her as a dependent but you may deduct her medical expenses

(b) Claim her as a dependent and deduct her medical expenses

(c) Not claim her as a dependent and you may not deduct her medical expenses

5. *You filled very few inside straights during the past few months and lost approximately $300 to the members of your Thursday night poker club. You should ....*

(a) Deduct the loss in computing adjusted gross income

(b) Subtract the loss from adjusted gross income

(c) Give up poker and start watching television on Thursday nights

6. *Last October your car skidded on a wet road and grazed a telephone pole. The damage was not covered by insurance and it cost you $100 to have the car repaired. To claim a casualty deduction ....*

(a) You must have the damage repaired within 30 days of the accident

(b) You may simply deduct the amount of the repair bill

(c) You must prove that you were using the car in your work at the time of the accident

7. *Which of the following may you not consider as a deductible business expense ....*

(a) A subscription to PIPE LINE INDUSTRY

(b) Commutation fees

(c) The costs of attending engineering society conventions

8. *While playing hide-and-seek in your backyard, the neighbor's children trampled and killed several of your more expensive bushes. The cost of replacing this shrubbery ....*

(a) May be deducted if it does not exceed the original cost of the bushes

(b) May be deducted only if the parents of the children refuse to pay damages

(c) May not be deducted under any circumstances

9. *Last year you gave your church a small piece of property for which you had paid $500 some time ago. Its value at the time of the gift was $1500. As a result ....*

(a) You may claim a tax deduction of $1500

(b) You must pay a capital gain tax on the $1000 increase

(c) You may claim a tax reduction of $500

10. *After you have filed your per-*

Continued on Page 64

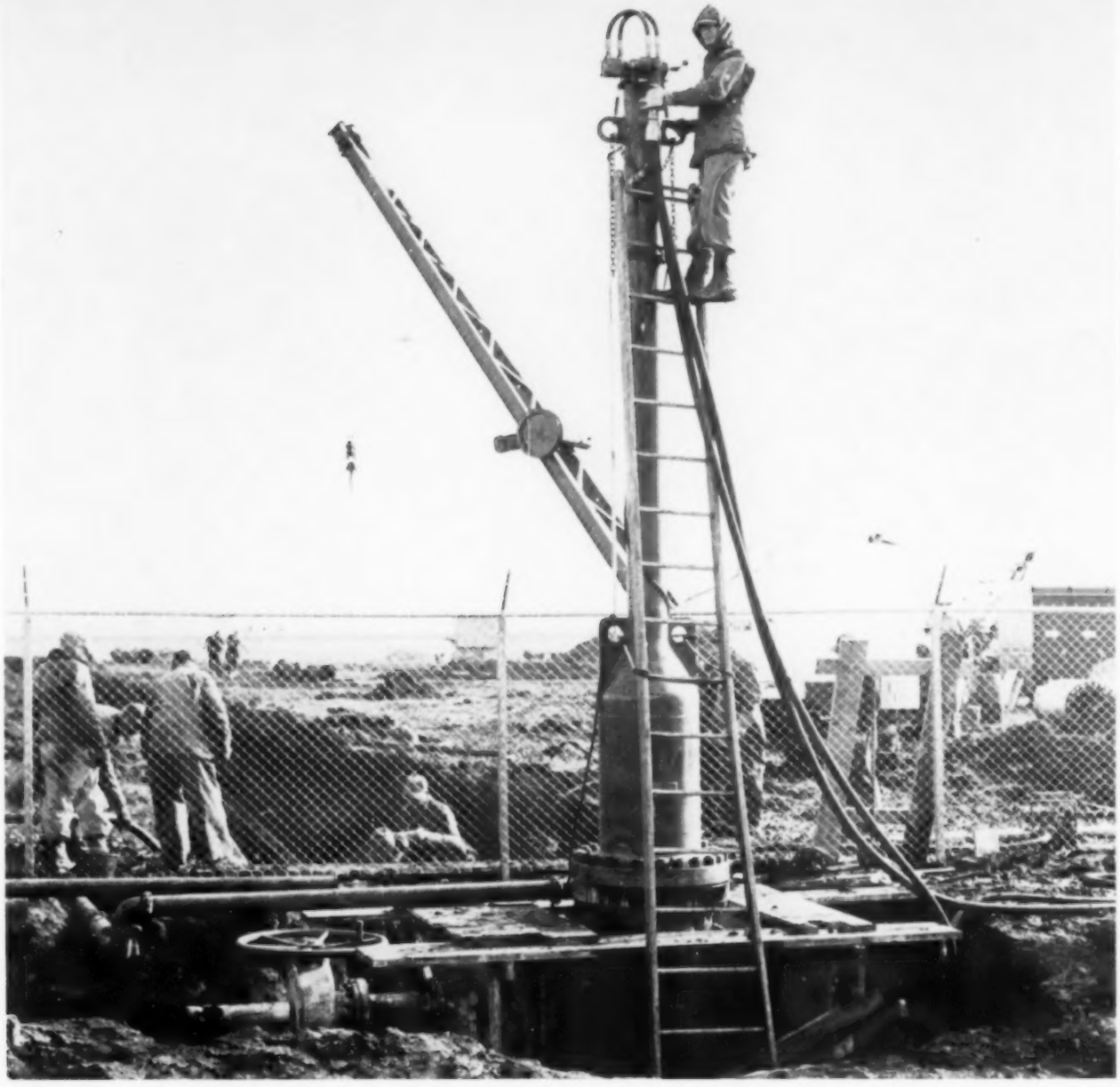


FIGURE 1—Giant stopple was installed to block flow in Service's 22-inch main line at Streator, Ill. Only 1,100 barrels of crude had to be transferred, instead of estimated 12,000 barrels that would have been necessary had line not been blocked.

Five Tie-Ins Completed in One Day

Use of king-sized, hydraulically operated stopple units, plus detailed advance planning by Service Pipe Line crews cut downtime to a minimum.

By **Richard F. Gavitt**
Service Pipe Line Company, Tulsa

MAKING FIVE tie-ins at scattered points along a 20- and 22-inch crude oil pipe line in one day of muddy weather is not a job that most maintenance crews would look forward to. But looking ahead and planning for that day months in advance enabled Service Pipe Line Company crews to anticipate the problems and provide virtually all of the answers. One problem that was thought about, but not completely solved, was the weather.

This project was made necessary by a system expansion that increased winter capacity of the company's

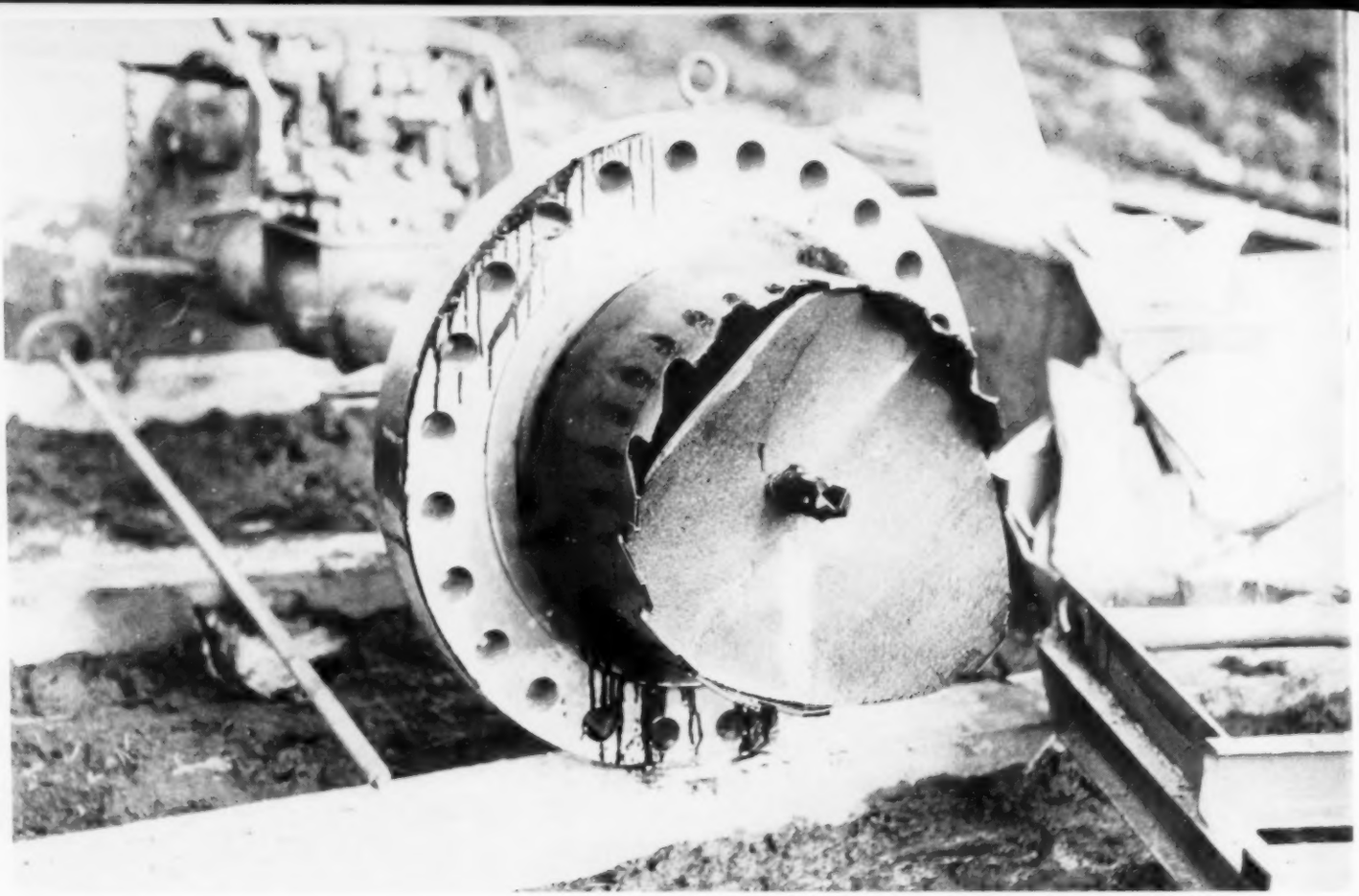


FIGURE 2—A 22-inch mill cutter removes coupon from main line tie-in at Streator. Next, stopple was inserted to block flow.

FIGURE 3—This split tee was welded onto the main line in preparation for the tap. View shows the lock O-ring in place. Cone shaped object in center is plug holder, which was removed before installation of the blind flange.

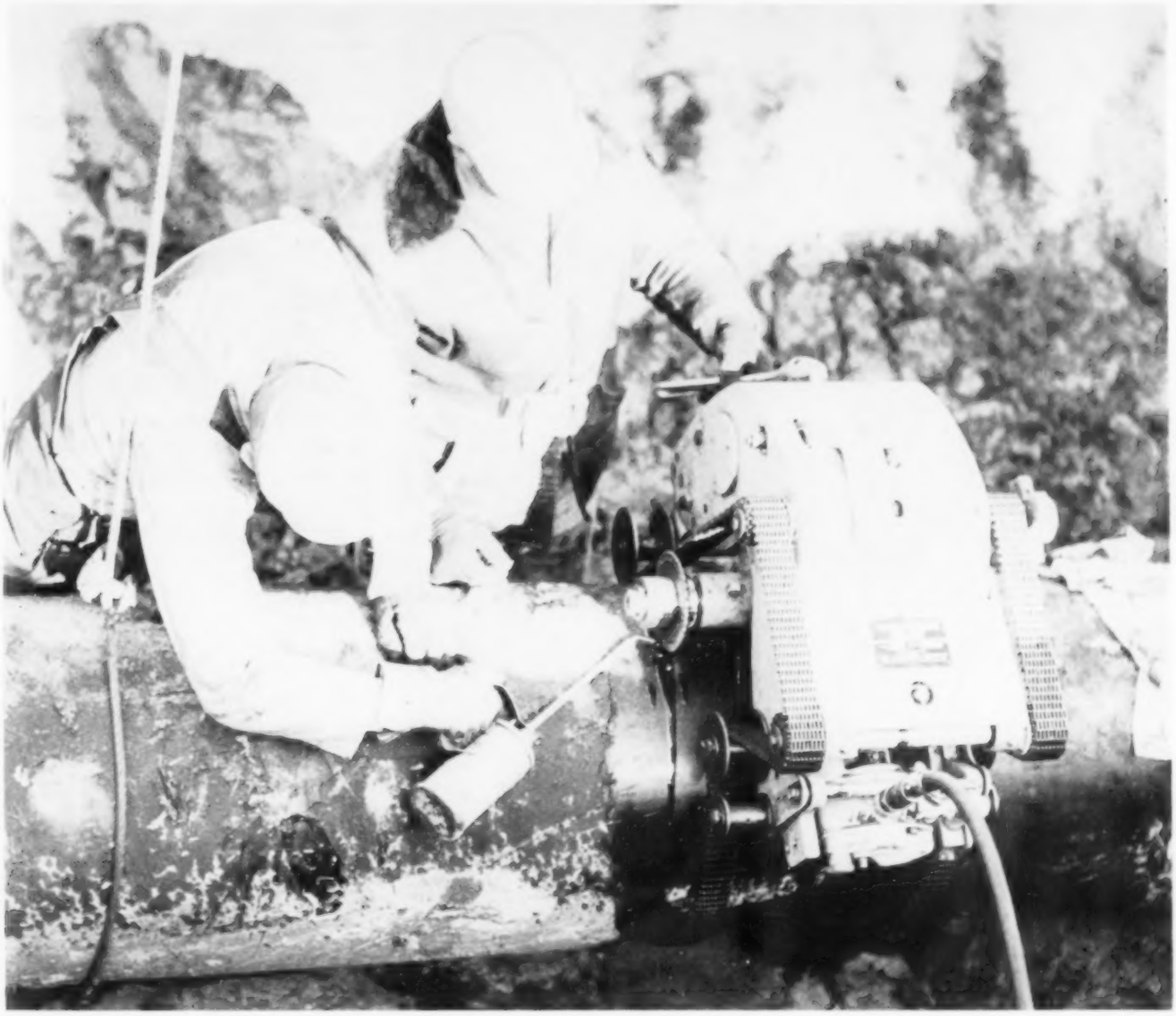


FIGURE 4—Only a few hours after tie-in began, the line had been plugged, drained, and first pipe cut was being made.

main line by 29,000 barrels per day between Freeman and La Plata, Mo., and by 40,000 barrels daily from La Plata to Manhattan, Ill.

Three new pumping stations were installed on the system and pumping horsepower was added at four existing stations. At Ormonde and Streator, Ill., single-unit, unattended electric-centrifugal stations of 2,500 horsepower were added to the system; a 2,000-horsepower station with the same type unit was also completed at Medill, Mo. Additional pumping units were also installed at Mayview and Rothville, Mo., and at Laura and Manhattan, Ill.

Scheduling of Materials. Tieing in manifold piping and installing block valves at five intermediate points along the line was complicated by the large quantities of oil that had to be transferred prior to cutting the line.

Initial plans for the tie-in project were made almost as soon as construction of the stations began. These developed through the summer months as construction progressed. Orders went out for the rental of some of the pieces of heavy equipment that would be needed; among them a tapping machine with hydraulic power unit, a stopple with hydraulic drive, and stopple cutters. Pipe fabrication for each of the installation sites was done at the company's Tulsa shops. Actual tie-ins were done entirely by Service maintenance crews.

Conference Makes Final Plans. Much of the detailed planning was done at a meeting in Galesburg, Ill., on October 24. This conference brought together district superintendents and other district personnel directly involved, and representatives of the engineering and maintenance departments from the general office in Tulsa.

Two innovations were to be tried on this project. One of these involved using the largest stopple Service had ever applied to block the flow of oil in the 22-inch line of the number one system at Streator; another new technique for the tie-in crews was the use of drilling mud for plugs to seal the line preparatory to making welds.

Large Stopple at Streator. At the Streator location, it was estimated that between 9,000 and 12,000 barrels of oil would have to be transferred to another system unless some

FIGURE 5—Crews work in ankle deep mud while bevelling the pipe downstream from the stopple. Pressure upstream from the plug was about 55 psi. To seal off vapors during welding, mud plugs made of bentonite were tamped in the open ends.

special steps were taken. This would have required heavy-duty, large-volume pumps; even with these, the emptying time would be considerably longer than the scheduled shutdown would allow. Use of the 22-inch stopple was the answer; by using it, only 1,800 barrels had to be transferred there.

Drilling Mud Plugs Pipe. Mud plugs made up of bentonite were used to seal off the ends of the line to prevent the escape of gaseous vapors during welding. With clay soil plugs used previously, trouble usually arose after the job was over and the plugs were pushed on through the line. Rocks and foreign matter, reaching stations down stream, endangered the precise mechanical seals and wear rings of centrifugal pumps.

For this tie-in job, Service decided to try bentonitic clay, which it was thought would improve the sealing characteristics of the plugs as well.

Shop Checks Mud Mix. Preliminary tests were made on the bentonite plugs in the Tulsa shops. Three separate tests were made on a 12-foot section of 20-inch pipe, sealed at one end with a welded steel plate containing a quarter-inch nipple for an air regulator and pressure gage. Three hundred pounds of bentonite was mixed with water, 11 gallons per 100 pounds, and a plug tamped into the open end of the pipe. The plug was tested at pressures of 5, 8, psi; it was blown out of the pipe at a pressure of 11 psi.

On one of the later tests, it was found that the addition of a small amount of hydrated lime to the mixture produced a plug that held under 5 psi pressure for 24 hours with no appreciable loss or leakage.—**The End**

Your Income Tax IQ

(Continued from Page 60)

sonal 1957 tax return, the government is allowed to check your return and bill you for additional tax. The period of time in which this may be done ends . . . .

(a) On the day you file your 1958 return
(b) Two years after you file your 1957 return
(c) Three years from the due date of your 1957 return

11. *On the advice of a friend, you engage a CPA to prepare your 1957 tax return. The fee he charges for this service is . . . .*

(a) Not deductible since it is a personal expense
(b) Not deductible if you are entitled to a refund
(c) Deductible in full

CORRECT ANSWERS

1. (c) The money you received from the company must be reported as income, but you may deduct the cost of moving your entire family. If the amount the company gives you exceeds your expense, the excess is taxable. Conversely, however, if your expenses were more than the amount received, the difference is not deductible.

2. (a) and (b) are both correct. All taxpayers are entitled to a $50 dividend exemption. A husband and wife can combine their exemptions and receive $100 in dividends tax free, providing the stock is jointly owned. The filing of a joint return will not qualify them for this double exemption if the stock is held in only one of their names.

3. (c) You cannot deduct contributions to an organization which spends a substantial part of its time lobbying or distributing political propaganda.

4. (a) You gained a son-in-law but lost a $600 dependency exemption for 1957 when your daughter married in November. All is not lost, however. If you provided more than one-half of your daughter's support during the year, you may claim her medical expenses as a deduction on your return.

5. (c) Watching television can be most relaxing and it might even help you to forget your poker losses—which is the thing to do because net gambling

losses are definitely not deductible. Net gambling gains are taxable as income; so if you won money in a football pool or other sources, you may use your poker losses to offset these gains.

6. (b) the IRS has ruled that "if the repairs do nothing more than restore the property to its condition immediately before the casualty and do not add to (its) value, utility or useful life, such repair costs may be used as a measure of the value of the destroyed portion." Where you were going at the time of the accident does not affect the deductibility of car damages.

7. (b) Commutation fees are not a deductible business expense. The cost of going to and returning from work, whether it be by bus, cab, train or plane, is not deductible since it is a personal expense. On the other hand, a and c are deductible.

8. (c) Damage to your shrubbery caused by children, dogs or errant lawnmowers is not deductible. If your home or lawn is damaged by fire, storm or flood the loss not covered by insurance may be deducted. When large amounts are involved it is wise to have an expert appraisal made immediately after the casualty.

9. (a) Your deduction for a charitable contribution is the value of the gift at the time it is made. You are not considered to have realized a taxable gain or deductible loss when you give property away. You may claim a deduction for the entire $1500 so long as this amount does not exceed 20 percent (30 percent in some cases) of your adjusted gross income.

10. (c) In the absence of fraud or substantial understatement of income, the Government has three years from the due date of your 1957 return to check your return and bill you for additional tax. Since the due date of most individual returns is April 15 and for investigation purposes all returns are treated as though filed on the due date, you should be sure to save all check stubs and receipted bills to prove your declared deductions until April 15, 1961.

11. (c) The fee which a CPA charges you to prepare a tax return or defend the accuracy of your return before the Treasury department is deductible in full if you itemize deductions. —**The End**

If Oil Could Speak

If oil could speak it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry.

But, oil can't speak—you can. You, as an individual, can win many new friends for the oil industry if you will pass the true facts on to your non-oil industry friends.

Here are some of those true facts. They are being presented for one purpose: To keep you posted on your industry, so you can tell the story oil is unable to relate.

Read these facts. You will find them informative—and interesting.

"If Oil Could Speak" it would tell the American public:

How Large Is the Pipe Line Industry?

Fifty-six years ago, the entire petroleum pipe line industry was made up of less than 18,000 miles of pipe lines—all of them for crude oil. Now there are more than 152,100 miles of crude, and 36,400 miles of products lines, equal to 85 percent of the rail line mileage in the U. S. Since 1949, more than 36,000 of pipe lines have been built, costing more than 1.5 billion dollars.

How Much Oil Is Produced, Compared With Other Natural Resources?

Total U. S. production in the past ten years is valued at 62 billion dollars —about equal to the total value of all other minerals, metals and fuels produced in the nation.

Is the Motorist's Gasoline Dollar Decreasing in Value?

Definitely not. Today's gasoline does 50 percent more useful work per gallon in a modern high compression engine than gasoline bought in 1925. In fact, one hour's pay is good for nine gallons of gasoline, compared with eight in 1952. In the past five years, gasoline prices have gone up a little more than four pennies per gallon. Of that increase—1½ pennies went for added taxes.

How Is Oil Transported to the Consumer?

More than 188,500 miles of petroleum pipe lines, 1500 barges, 490 tankers, 123,000 railway tank cars and 81,400 tank trucks are part of the mammoth transportation system that delivers more than 135 billion gallons of oil products to consumers every year—8.8 quarts daily for each man, woman and child in the nation.

Are Oil Industry Employe Benefits as High as Other Industries?

The following answer speaks for itself: According to the U. S. Chamber of Commerce, the oil industry pays the highest average yearly salary—$5259! Welfare benefits cost the oil industry $1278 a year for each employe —the highest fringe benefits in U. S. industry. The oil refining industry alone must have a capital investment of $38,000 per employe. For all manufacturing industries, the average is $8600.

To What Extent Does the U. S. Depend on Oil?

Machines, that depend on petroleum for virtually all their lubrication and almost three-quarters of their fuel, now do almost 99 percent of the work in this country. The weekly energy output of petroleum in the U. S. has been estimated to be around 40 hours work of more than 65 billion people—24 times the total population of the world.

Rules of Thumb

and Engineering Data Sheets for the Pipeliner's field notebook

$25 for Engineering Data Sheet $15 for Rule of Thumb

These practical aids give quick, reasonably accurate answers to design, maintenance and cost estimating problems. PIPE LINE INDUSTRY will pay $25 for each chart, nomograph or data sheet published—$15 for each Rule of Thumb. Send your ideas to PIPE LINE INDUSTRY, P. O. Box 2608, Houston, Texas

Corrosion Protection —16—Group Installation of Sacrificial Anodes.

When anodes are installed in groups, a spacing correction factor must be taken into account to determine the current output. The chart below shows the correction factor for multiple anode installations.

Example:

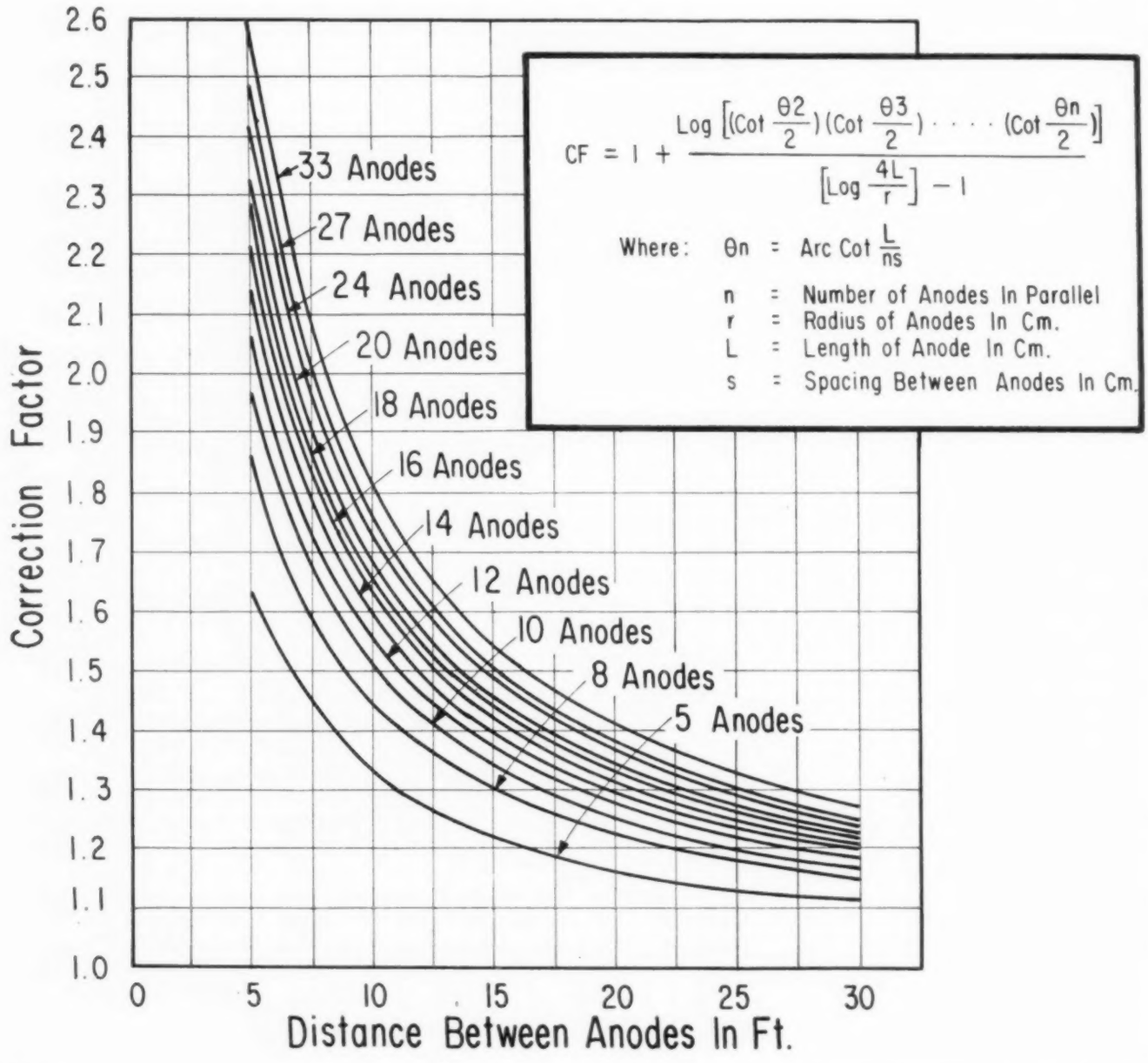
Single anode 8 inches by 60 inches in 1,500 ohm soil.

Resistance = 4.849 ohms.

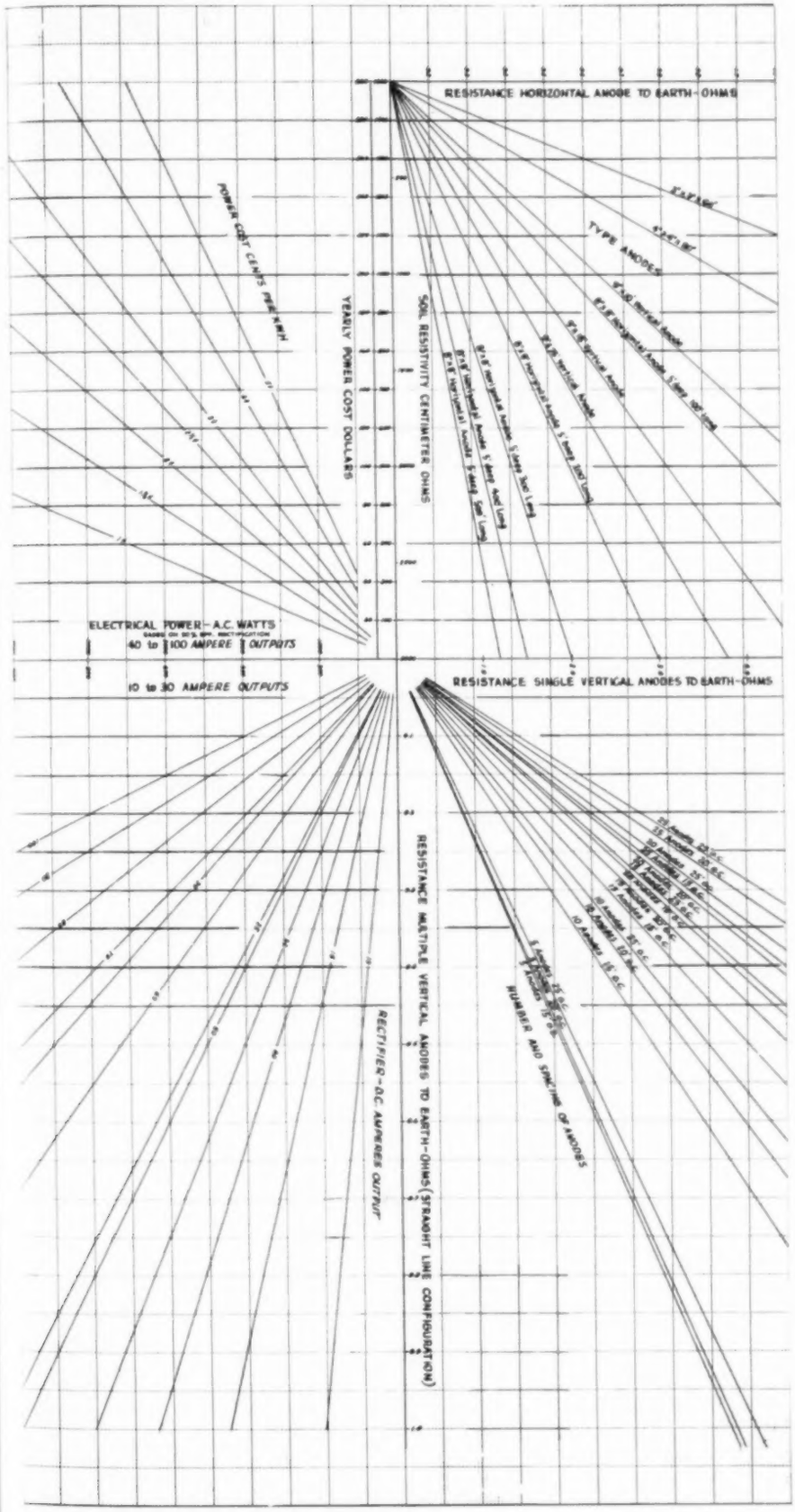
Potential = 0.85 volts.

Current output = $\frac{E}{R} = \frac{17.5 - 0.85}{4.849} = 0.185$ amps.

Current output of 5 anodes on 15 foot spacing under above conditions. Combined resistance of group = $\frac{4.849}{5}$ × 1.22 (correction factor) = 1.17 ohms. Total current output = $\frac{1.75 - 0.85}{1.17} = 0.769$ amps.



Corrosion Protection —17—Chart aids in calculating ground bed resistance and rectifier power costs.


RESISTANCE HORIZONTAL ANODE TO EARTH-OHMS
TYPE ANODES
POWER COST CENTS PER KWH
YEARLY POWER COST DOLLARS
SOIL RESISTIVITY CENTIMETER OHMS
ELECTRICAL POWER-A.C. WATTS
40 to 100 AMPERE OUTPUTS
10 to 30 AMPERE OUTPUTS
RESISTANCE SINGLE VERTICAL ANODES TO EARTH-OHMS
RESISTANCE MULTIPLE VERTICAL ANODES TO EARTH-OHMS (STRAIGHT LINE CONFIGURATION)
RECTIFIER-D.C. AMPERES OUTPUT
NUMBER AND SPACING OF ANODES

For conventional type ground beds this chart permits a rapid determination of the resistance to earth of various ground beds and the yearly power costs based on 50 percent efficient rectification. These curves are specifically designed for standard 3-inch by 60-inch and 4-inch by 80-inch graphite anodes centered in a vertical or horizontal excavation and backfilled to the dimensions indicated with well tamped coal coke breeze.

Example:
Soil resistivity—1,000 ohm-cms.
Power rate—3 cents per kwh.
Rectifier rating—20-ampere.

To determine the optimum size ground bed, enter the chart at the "Soil Resistivity-ohms-cms." line and extend a vertical line from the 1,000-ohm-cms. point to intersect all the anode types. Proceed horizontally to the left for the resistance to earth of horizontal type anodes and horizontally to the right for vertical type anodes. Various groups of vertical anodes with 15, 20 and 25-foot spacings are represented by curves.

Resistance values for horizontal anodes obtained from the ordinate of the upper left hand section should be transferred to the abscissa of the upper right hand section to determine power consumption and annual costs from the lower right hand and lower left hand section. In obtaining power costs for the two lower sections, the ordinate shows power consumption in AC watts based on 50 percent efficient rectification, and the abscissa of points on the lower left hand section indicated annual power costs in dollars.

How to

o Expedite a Pipe Line

J&L Electricweld line pipe is uniformly round. Wall thickness is constant. It lines up quickly, welds readily, and bends safely to any reasonable course. Lengths to 60 feet minimize field welds.

All J&L line pipe is finished and tested to meet ASTM and API specifications. Electricweld is furnished in sizes from 6⅝" through 12¾" O.D. Seamless line pipe in sizes 2⅜" O.D. through 14" O.D. is also available.

You'll want to know more about J&L's new Electricweld line pipe. Get the details from any J&L Supply man or write us at Tulsa — P. O. Drawer 2481.

Photo shows a line of coated and wrapped J&L 12¾" O.D. Electricweld being laid in Oklahoma.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

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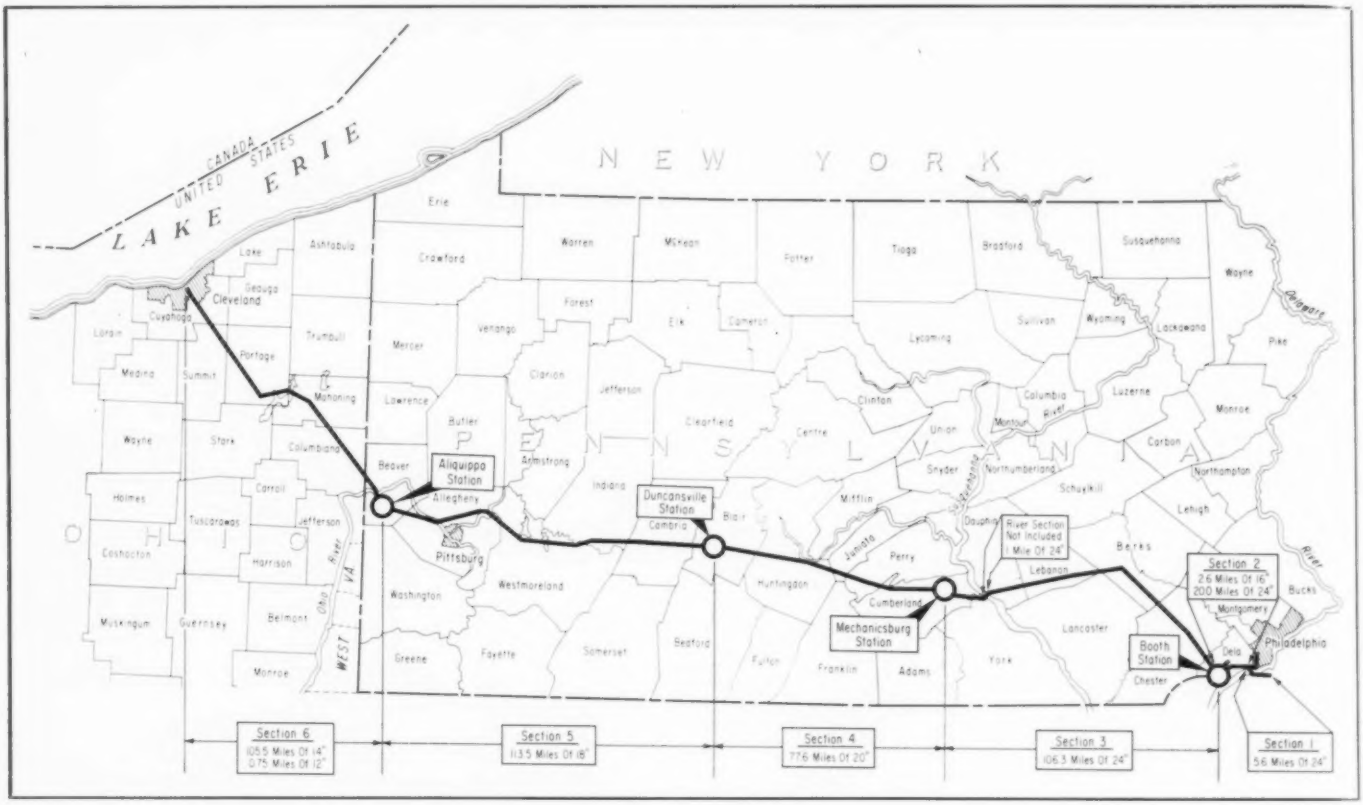
60



Laurel Pipe Line Company Lets Contracts On 440-Mile Philadelphia-Cleveland Line

Laurel Pipe Line Company has let contracts on its 440-mile products pipe line extending from the Philadelphia area to Cleveland, Ohio.

The line will consist of 126 miles of 24-inch; 77.6 miles of 20-inch; 113.5 miles of 18-inch and 106 miles of 14-inch. Four pump stations will be constructed at Booth, Delaware County; Mechanicsburg, located near Harrisburg; Duncanville, between Harrisburg and Pittsburgh; and Aliquippa, outside Pittsburgh.

Establishing a new mark in size for a products line is the 124 mile, 24-inch main line running from Philadelphia to Harrisburg.

Presently the 20-inch "Little Big Inch" line from Baytown, Texas, to Moundsville, W. Va., is the largest petroleum products line.

Laurel Pipe Line Company was formed in 1957 by Gulf Oil Corporation, Sinclair Pipe Line Company and The Texas Company. It will transport 160,000 barrels per day of petroleum products to Pittsburgh and 52,000 to Cleveland. The Laurel line will supplement existing products lines which are becoming inadequate for the growing demands of the Pennsylvania and Ohio markets.

A full line of products including gasoline, heating oils, and fuel oils will be taken off the line at 13 terminals in Pennsylvania and Ohio.

Construction on the $50 million project is scheduled to begin in April and it should be completed early in 1959. The Susquehanna River crossing, one of four crossings on the line, was awarded to Pipe Line Construction and Drilling Company last month, and construction on it will be under way soon.

Winning bidders and their mileage spread are:

Missouri Valley Dredging Company, 5.6 miles, 24-inch from Eagle Point, New Jersey to Delaware River, including Delaware River crossing; and 20 miles, 24-inch from Delaware River to Booth station in Delaware County.

Engineers Limited Pipe Line Company, 106 miles 24-inch, from Booth Station to Mechanicsburg Station near Harrisburg.

Pipe Line Construction and Drilling Company, one mile, 24-inch Susquehanna River crossing.

Panama, Inc., 78 miles, 20-inch between Mechanicsburg and Duncansville Stations; 113 miles, 18-inch from Duncansville Station to Aliquippa Station in Beaver County. This section includes crossing of the Allegheny and Ohio Rivers.

Williams Brothers Company, 106 miles, 14-inch, from Aliquippa to Cleveland.

Humble Awards Contract On 90-Mile Texas Crude Line

Humble Pipe Line Company has awarded contract on its 90-mile, 16-inch crude line between Hawley and Comyn, Texas. O. R. Burden Construction Corporation has been awarded the contract and will set up headquarters in Cisco, Texas. The new line extending Humble's Panhandle-Gulf Coast system, will have a capacity of 99,000 barrels per day.

The line will extend from Hawley, located in Jones County, West Central Texas, eastward to Comyn in Commanche County.

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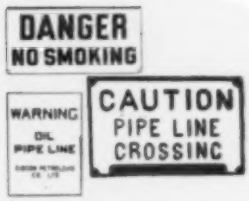

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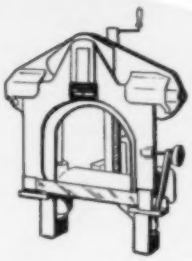

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Gas Odorizers
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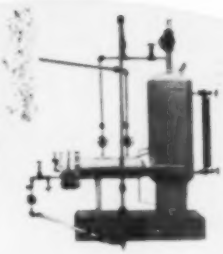

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Topaz sales engineers will
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For more data on advertised products, use Readers' Service Cards, last page.

United Gas Pipe Line Company Seeks FPC Permission to Build 203-Mile Line

United Gas Pipe Line Company is seeking Federal Power Commission permission to construct approximately 203 miles of 30-inch natural gas line between New Orleans and Mobile, Ala.

In its application United Gas Pipe Line Company stated that the new line, which will parallel an existing United Gas line, is necessary to enable the company to continue to supply the gas requirements to its present customers in the Mobile-Pensacola, Fla. area and along the route of the New Orleans-Mobile line.

The $33.8 million project would be constructed in two phases: the first includes 78.7 miles from a point near New Orleans to Hancock County, Miss., and 38 miles from Harrison County, Miss., to Jackson County, Miss. The second phase consists of 86 miles of pipe line paralleling sections of the company's southeast Louisiana-Mobile line.

For precise pneumatic control operation . . .

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Put an end to pneumatic control stoppages due to freezing, corrosion, and vapor locks. Install famous Kemp Oriad Dryers on your air lines to remove moisture and dirt. . .keep controls and delicate instruments operating smoothly and accurately.

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KEMP OF BALTIMORE

Available in all sizes for automatic, semi-automatic, or manual operation. Steam or electric reactivation.

Interprovincial Awards Contract for Looping

Interprovincial Pipe Line Company has awarded contract on its looping program in Alberta and Saskatchewan. Piggott Construction, Ltd. will construct 82 miles of 24-inch pipe in four loops extending from the pumping stations at Edmonton and Hardisty, Alberta, and Kerrobert and Loreburn, Saskatchewan.

Construction is scheduled to start in June and to be completed by September. This added looping which connects with loops constructed since 1954 will give Interprovincial a double crude line extending from Edmonton to Superior, Wis. A total of 1,098 miles of the 1,931-mile line will have been looped by the end of the year.

Further expansion planned for the crude system reaching from Edmonton, Alberta, to Ontario includes addition of 2,040-horsepower diesel pumping units at Regina and Glenavon stations in Saskatchewan, and Cromer and Glenboro stations, Manitoba.

The completion of these facilities will raise the capacity of the Interprovincial line to 275,000 bpd from Edmonton and 379,000 bpd from Cromer.

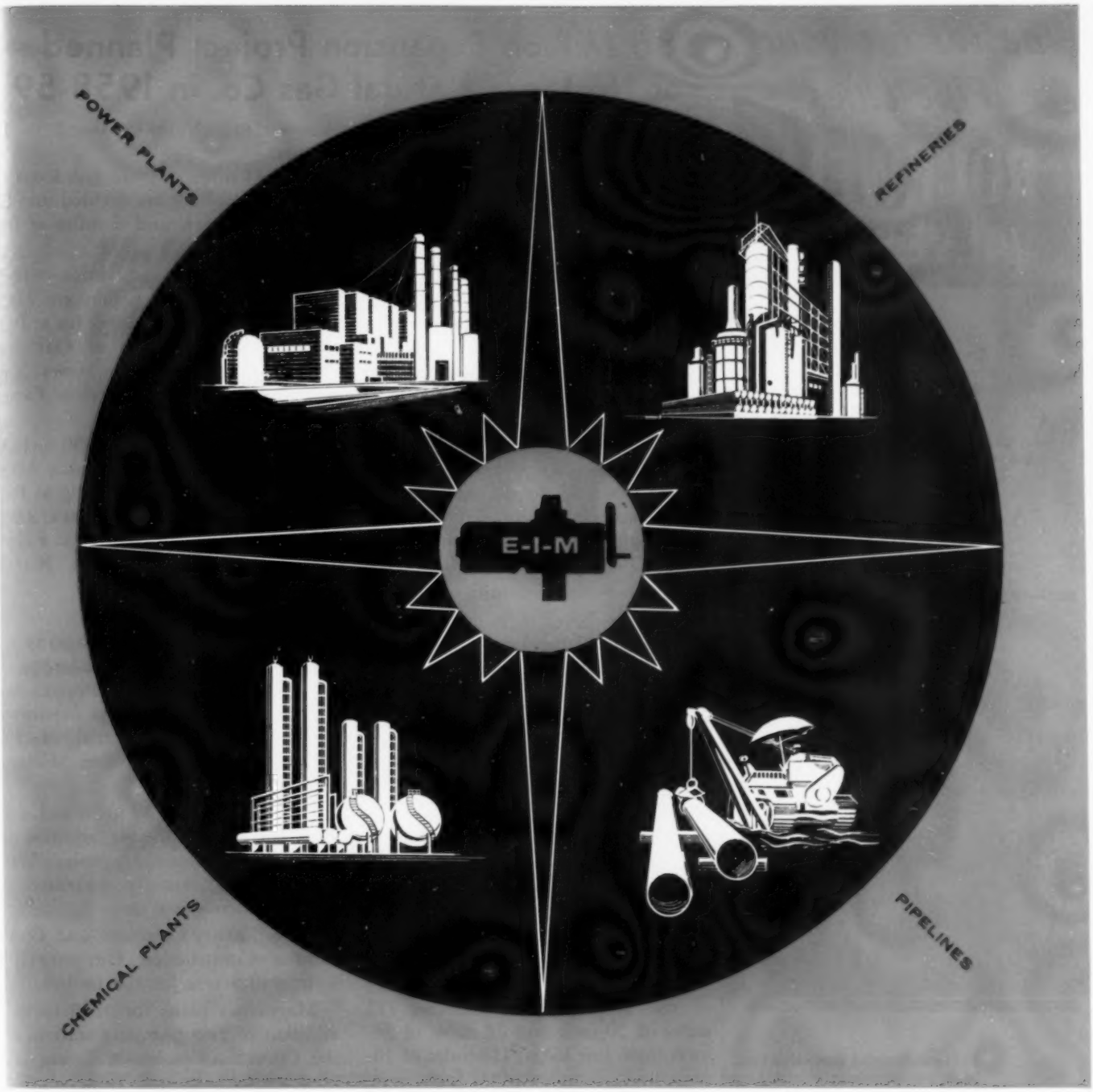
This is the second major expansion program on the Interprovincial crude line within a year. Last spring a 156-mile, 20-inch main line extension from Sarnia to Port Credit, Ont., was constructed.

Sinclair and Skelly Build Field Gas Gathering System

Sinclair Oil & Gas Company and Skelly Oil Company are completing an extensive field gas gathering system connecting six fields in Schleicher and Tom Green counties, Texas, to their gas products plant in Hulldale field.

A 25-mile, 8-inch gas line extends from Pecan Station to Mt. Sudan field to the plant in Hulldale. Connecting the Toenail Trail field, Otto field, Tillery field and O'Harrow field is a 32-mile system of 8-inch pipe.

A 200-horsepower compressor has been installed at the Pecan station and Mt. Susan field to boost the gathering system. The engine block for a 550-hp compressor has been completed in the O'Harrow field. This compressor will handle casing head gas production from Otto, O'Harrow, Butler and Toenail fields.



industrial leaders use E-I-M valve controls

These are some of the major crude and products transmission line operators who always specify E. I. M. equipment. Arabian American Oil Corporation; Humble Pipe Line Company; Platte Pipe Line Company; Service Pipe Line Company; Shell Pipe Line Corporation; Sinclair Pipe Line Company.

E-I-M *Company*
INCORPORATED

1340 OLD SPANISH TRAIL • HOUSTON 25, TEXAS • MOhawk 4-4587
Valve Controls • Speed Reducers • Cooling Tower Drives • Control Valves

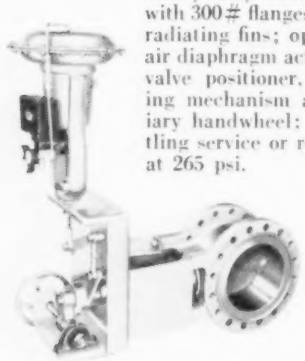
For more data on advertised products, use Readers' Service Cards, last page.

Better for your Pipe Lines

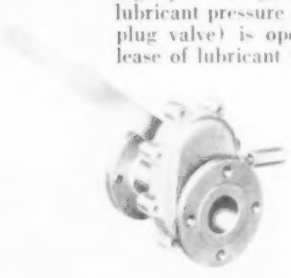
ROCKWELL VALVES

Heavy duty, wafer-type butterfly valve with worm gear and handwheel for high pressure and for high temperature service in pipe line flow control and shut-off of petroleum, gas or water.

Heavy duty butterfly valve with 300# flanges and heat-radiating fins; operated by air diaphragm actuator and valve positioner, declutching mechanism and auxiliary handwheel; for throttling service or recycle gas at 265 psi.



Lubricated swing gate valve for high pressure gas; closed by lubricant pressure and (unlike plug valve) is opened by release of lubricant pressure.



Rockwell valves for petroleum production, refining and pipe line service are designed in many types with manual or automatic control operators, in required metals, body linings and pipe sizes. Write for catalog.

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$86 Million Expansion Project Planned For Northern Natural Gas Co. in 1958-59

Northern Natural Gas Company proposes to construct new pipe lines and facilities in 1958-59 at a cost of $86 million to serve 390 more communities in the Northern Plains.

Construction plans for 1958 call for 233 miles of main line extensions, 147 miles of main line loops, 9 miles of branch line loops, 1,490 miles of miscellaneous branch lines, and five compressor station additions totaling 12,000 horsepower.

This year's proposed program would add 128 MMcf per day to Northern's capacity, and 74 MMcf per day would be added with the 1959 construction.

Tentative plans for 1959 include 74 miles of main line loops and seven compressor station additions totaling 20,000 h.p.

Northern Natural presently has before the Federal Power Commission an application submitted in 1957 for construction of 365 miles of main line, and 1,090 miles of branch lines.

The big project before the FPC includes a main line extension from Farmington to Iron Junction, Minn. and a main line from Farmington, Minn., to St. Cloud, Minn.

The main construction which would be undertaken in 1958 is a line running from St. Cloud to Grand Forks, North Dakota.

The breakdown on the pipe sizes of the 1958 proposal includes 115 miles of 30-inch and 32 miles of 24-inch main line loops; 158 miles of 16-inch and 75 miles of 12-inch main line extensions; 3½ miles of 10-inch and 5½ miles of 6-inch branch line loops; and 1,490 miles of miscellaneous branch lines from 2 to 10 inches.

The 74 miles of main line loops to be added in 1959 are divided into 68 miles of 30-inch and 6 miles of 24-inch.

Compressor station additions scheduled for 1958 construction are 2,000 hp at Beaver, Okla.; 2,000 hp at Palmyra, Neb.; 2,000 hp at Oakland, Iowa; 2,000 at Ventura, Iowa; and 4,000 hp at a new station in Farmington.

Additions planned for 1959 include 4,000 hp at Mullinville, Kansas; 4,000 hp at Beatrice, Neb.; 2,000 hp at Palmyra; 2,000 hp at Ogden, Iowa; 2,000 at Ventura, Iowa; 2,000 hp at Farmington; and 4,000 hp at North Branch, Minn.

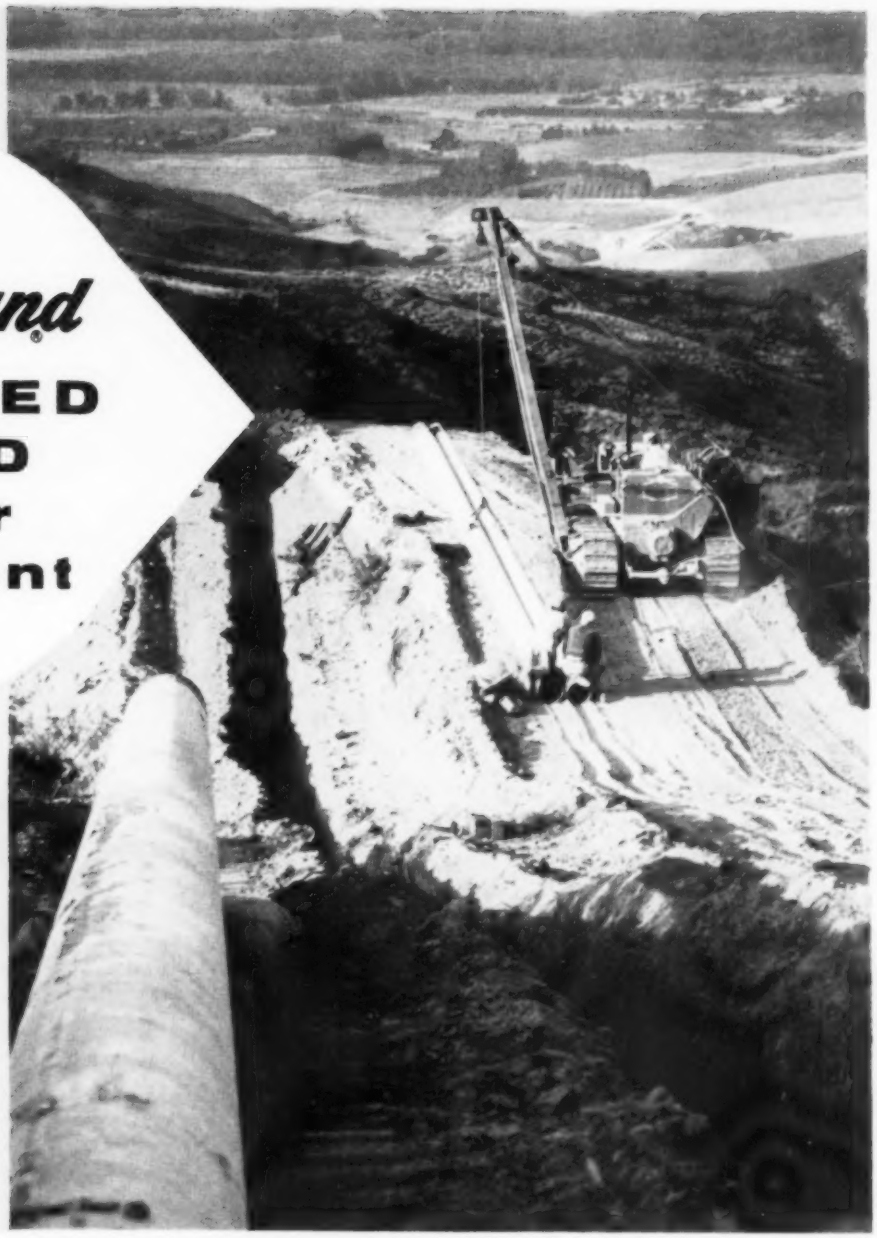
Magnolia Pipe Line Company Constructs 250 Miles of Loops

Magnolia Pipe Line Company has completed its West Texas expansion program with construction of 250 miles of loop lines between Midland and Corsicana.

Pipe varied from 12 to 20 inches in diameter, and with the addition of pumping equipment, Magnolia's West Texas crude capacity increased to 235,000 barrels per day.

H. B. Zachry Company and O. R. Burden Construction Corporation were contractors for the project.

Magnolia's plans for 1958 include addition of two pumping stations on the Corsicana-Beaumont, Texas, segment of its main line. These new stations will boost East Texas crude capacity from 175,000 barrels per day to 235,000 bpd.



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FLATTENED STRAND on your equipment
—is money in your pocket!

Yellow Strand Flattened Strand Wire Rope on your pipelayers, shovels, bulldozers and ditchers *does* put money in your pocket! *Here's Savings No. 1:* Yellow Strand Flattened Strand lasts *twice* —or more—as long as ordinary rope and gives you 10% greater strength. *Savings No. 2:* fewer breakdowns, you make fewer rope changes. You measure the difference in dollars in your pocket! Your Broderick & Bascom Distributor will be glad to tell you more about this better wearing, longer lasting product—as well as the many other B & B products. See him soon! Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Mo.

Here's a difference you can see:

Compare Yellow Strand Flattened Strand (left) with ordinary wire rope (right). Note that Flattened Strand gives you 12 contact points, with consequent greater bearing area and smoother surface. As a result, both rope and sheaves give longer service, lower final cost.

Yellow Strand® Wire Rope

Commonwealth Oil Company Begins Construction on Offshore Gas Line

Commonwealth Oil Company has started construction work on a 10-mile gas gathering line in West Delta area about 18 miles from the Louisiana coast for Tennessee Gas Transmission Company.

The 12¾-inch concrete-coated pipe is being laid by the "Magic," Commonwealth's pipe laying barge. The line will interconnect gas wells of the Continental Oil Company in Louisiana offshore blocks 54, 58 and 59 with a Tennessee Gas line extending to the mainland in the West Delta area.

Commonwealth is constructing the line under water approximately 55 feet deep and in trenches ranging from 6 to 10 feet deep which will be backfilled. Location is about 20 miles south of Venice, La., the base of operations for the pipe laying project.

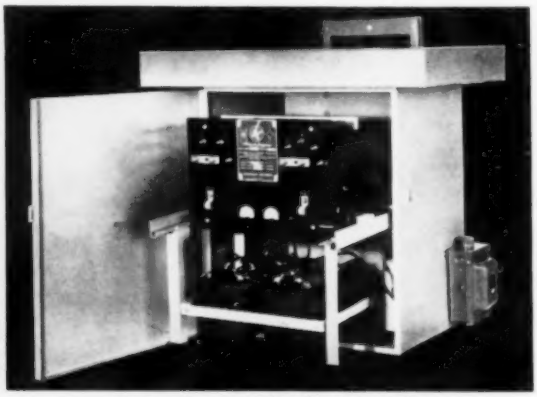
The offshore construction should be completed within 45 days.

EXTRA *DEPENDABILITY*

FOR ANY CATHODIC PROTECTION PROGRAM

HOLCOMBE SELENIUM RECTIFIERS

Small size steel cabinet rectifier.



Medium size steel cabinet rectifier.

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Cherokee Awards Contract On 87-Mile Products Line

Cherokee Pipe Line Company has awarded contract on its 87 mile, 12-inch products line from Ponca City to Glenpool—near Tulsa. Pipeline Service Corporation was awarded the contract and will begin construction this month. The $5.5 million project will also include conversion of a crude line to products running from Glenpool to Wood River, Ill.

Cherokee Pipe Line Company was organized by Continental Oil Company and Cities Service Pipe Line Company in 1954 and now owns a products line extending from Ponca City to Wichita, Kansas, and to Oklahoma City and Wood River. Cherokee also has a crude oil gathering system in Oklahoma. The crude trunk line to be converted to a products line will connect with the new Ponca City-Glenpool line.

Construction of pump stations at Afton, Okla., and Richmond, Mo., and additions to existing stations at Ponca City, Glenpool, and Mount Vernon and Bell, Mo., will raise the capacity of the Cherokee system to 60,000 barrels daily.

Continental Pipe Line Co. Announces Expansion Project

Continental Pipe Line Company has announced a $430,000 expansion project for the Rocky Mountain area. Three new pump stations and new delivery facilities will be constructed. The installations will take place along the 230-mile pipe line system between Lance Creek, Wyo., and Denver.

A pump station and delivery facilities will be built at Cheyenne, Wyo. Three storage tanks for crude oil, with a total capacity of 100,000 barrels, will be added to the Cheyenne terminal.

A second pump staiton will be constructed near Little Bear, Wyo., 33 miles north of Cheyenne, and the third station will be built midway between Little Bear and Guernsey, Wyo.

With completion of the project the Guernsey to Cheyenne portion of the line will have an initial capacity of 46,000 barrels per day and the Cheyenne-to-Denver segment will have a 34,000 bpd capacity.

Contract for the expansion program has been awarded to Oil Capital Construction Company—work is to begin March 15, and completion is expected by June 15.

For protection that lasts— paint your buildings and equipment with Humble's **RUST-BAN**®

Humble's RUST-BAN protective coatings will give your valuable buildings and equipment long-lasting protection. RUST-BAN is available in a wide range of finish colors that will improve the appearance of your buildings, trucks, tractors and other equipment.

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Humble produces a complete line of RUST-BAN protective coatings, each designed for a special purpose. There are RUST-BANS to protect all types of surfaces—wood, metal and masonry.

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For more data on advertised products, use Readers' Service Cards, last page.

PROPOSED PIPE LINE CONSTRUCTION

Here in convenient summary form is Pipe Line Industry's listing of company, line size, length, service, location and project status.

U. S.

American Louisiana Pipe Line Co., Detroit, Mich., 12.2 miles, 12 and 16-inch, gas, lines and facilities to connect North Holly Beach Field and Second Bayou Field, Cameron Parish, La. with its existing facilities, $1.4 million, before FPC.

Cherokee Pipe Line Company, Ponca City, Oklahoma, 87 miles, 12-inch, products. Ponca City to Glenpool terminal, Tulsa, contract let to Pipeline Service Corp.

Chicago District Pipeline Company, 52 miles, 30-36 inch, gas, from Natural Gas' proposed line at Joliet to Chicago, $13 million, before FPC.

Cities Service Gas Co., Oklahoma City, 116 miles, gas, facilities in Kansas and Oklahoma and pipe lines in Kansas, $11.4 million, authorized.

41 miles, 30-inch from Verdigris River to the Petrolia compressor station; 33 miles, 30-inch between the Petrolia and Walda compressor stations; 4 miles, 4-inch in Wilson County, Kansas, and 6 miles, 12-inch gas line in Reno County, Kansas, plus replacement of facilities in Kansas, $6.5 million, temporary FPC authorization.

Coastal States Gas Producing Co., Corpus Christi, Texas, 45-mile, gas gathering system in Bee County, Texas to connect with Texas Eastern's main pipe line, $1 million, planned.

Coastal Transmission Corp., Houston, 574 miles, 22-24 inch, gas, from McAllen, Texas to Baton Rouge, La. connection of Houston, Texas Gas and Oil plus 414 miles of laterals, $55 million, authorized.

Colorado Interstate Gas Co., Colorado Springs, 734 miles, 24-30 inch, gas, from Texas & Okla. Panhandle to Kit Carson, Colo., to Beatrice, Neb., plus four compressor stations, $87 million, before FPC.

50 miles, 22 inch, gas, from Mocane area to existing system at Hooker, Okla., authorized.

Conn-Mass Pipe Line, Inc., Orange, Conn., 88 miles, 8 inch, products, from Boston to Springfield, Mass., planned.

133 miles, 16-inch, products, from Linden, N. J. to Hartford, Conn., planned.

62.2 miles, 8-inch, products, from New Haven, Conn. to Springfield, Mass., planned.

38 miles, 6-inch, products, from Waltham, Mass. to Fitchburg, Mass., planned.

Deep Rock Gas Co., Oklahoma City, 120 miles, 6-inch, LPG, from Tioga, N. D., to Canadian border, planned.

Derby Refining Co., 200 miles, 12 inch, crude, from Meade County, Kansas, to Wichita, Kansas, considered.

Eastern Shore Natural Gas Company, Salisbury, Md., 124 miles, 6 and 8-inch, gas facilities on eastern shore areas of Delaware and Maryland, $3 million, authorized.

El Paso Natural Gas Co., El Paso, 835 miles, 4½-34-inch, field and main lines, facilities in Texas, New Mexico and Arizona, $80 million, 362 miles authorized and contracts let. 4½ to 20-inch, field lateral lines, gas, in Texas, New Mexico and Arizona, authorized. $159 million, before FPC.

18 miles, 12-inch, gas, loop between Good Field and East Vealmoor, Texas, temporary FPC authorization.

Emerald Pipe Line Corp., 120 miles, 6 inch, products, from Sunray, Texas, to Tucumcari, N. M., planned.

Equitable Gas Company, Pittsburgh, Penn., development of Rhodes natural gas storage pool in Lewis County, W. Va., and construction of 11.7 miles of storage pipe line and other facilities, $2,091,430, authorized.

Gillette Pipeline Co., Cheyenne, Wyo., 103 miles, crude, from Dead Horse Creek field to Casper, Wyo., planned.

Great Northern Railway, St. Paul, 400-600 miles, 12-20 inch, crude, from Williston Basin to St. Paul-Minneapolis and Duluth-Superior areas, considered.

Gulf Interstate Gas Co., Houston, 12.8 miles, 6 and 20 inch, gas, loop line in Louisiana, $730,000, authorized.

350 miles, 30-inch, and 55 miles, 24-inch, loop lines in Kentucky, Mississippi, Tennessee, and Louisiana, $50 million, authorized.

Harry Bass & Sons, Inc., Dallas, pipe line network from well heads to compressor stations to central gasoline plant plus line to railroad in Pembina field, Alberta, $17 million, approved.

Home Gas Co., Pittsburgh, Penn., gas facilities in New York, $3.8 million, authorized.

Humble Oil & Refining Co., 250 miles, 26 or 30 inch, gas, and 200 miles, main gathering system, line of varying sizes, from southwest Texas to Houston, plus gas processing and cycling plant near Corpus Christi, $75 million, planned.

Humble Pipe Line Company, 90 miles, 16 inch, crude, from Hawley to Comyn, Texas, $3.5 million, contract let to O. R. Burden Construction Corp.

Iron Ranges Natural Gas Co., 115 miles, gas, from Itasca and St. Louis counties along route of Mesabi range from Grand Rapids to Aurora, Minn., $5 million, before FPC.

Jayhawk Pipe Line Corp., Wichita, Kansas, 242 miles, 10 and 12 inch, crude, from western Meade County to Valley Center, Kansas, $8.6 million, planned.

Katy and New York Central Railroads, 2500-mile, 10-12 inch, LPG, from Houston, Texas, to New York, Considered.

Kerr-McGee Oil Industries, Inc., 24 miles, 4 inch, gas, to connect wells with its Breton Sound production island off the Louisiana coast, authorized.

Laurel Pipe Line Co., Philadelphia, 440 miles, 12-24-inch products, from Philadelphia to Pittsburgh to Cleveland, $50 million, contracts let to Missouri Valley Dredging Co., Engineers Limited Pipe Line Co., Pipe Line Construction and Drilling Co., Panama, Inc., and William Brothers Co.

Magna Pipeline Co., 40 miles, gas, underwater line from Anacortes, Wash., to Victoria, B. C., $6 million, planned.

Manufacturers Light and Heat Co., Pittsburgh, Penn., 13.8 miles, 10 and 12 inch, gas, facilities in Ohio and West Virginia, $757,300, authorized.

Michigan Gas Storage Co., Jackson, Mich., gas, facilities in central Michigan, $2 million, authorized.

Michigan-Wisconsin Pipe Line Co., Detroit, 472 miles, 4- 24-inch, gas, main line loops and extensions in Wisconsin, Illinois, $17.6 million, before FPC, temporary authorization for a part, 47.5 miles let to G. E. T. Construction, Inc.

148 miles, 4-20 inch, gas, line to connect new gas supplies in Laverne field, Northwestern Oklahoma, planned.

Midwestern Gas Transmission Co., Houston, 2067 miles, 3-24 inch, gas, from Emerson, Manitoba, to Nashville, Tenn., $103 million, before FPC.

Mookl Chemical & Gas Corp., Tulsa, and **Missouri Transmission Corp.**, Springfield, Mo., 425 miles, 16-inch, gas, from Oklahoma City area to St. Louis, before FPC.

Natural Gas Pipe Line Co. of America, 416 miles, 36 inch, gas, loops at various points along existing line between Beatrice, Neb., and Joliet, Ill., $76.2 million, before FPC.

396 miles, 30-inch, gas, loops between company's terminus near Fritch, Texas and Joliet, Ill., $63 million, before FPC.

New York State Natural Gas Corp., Pittsburgh, Penn., gas, facilities in New York state, $1.2 million, authorized.

North Carolina Natural Gas Corp., 630 miles, 2-16 inch, from Transco's system near Mooresville across to southeastern North Carolina, authorized.

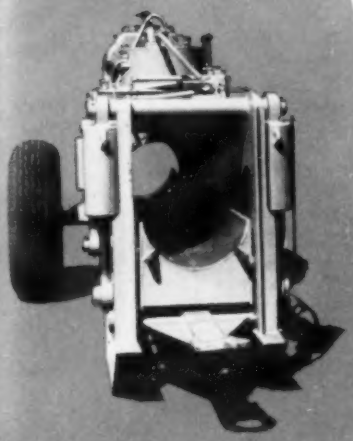
Northern Natural Gas Co., Omaha, 167 miles, 20 inch, gas, from Farmington, Minn. to Duluth, Minn., and Superior, Wis., $12 million, before FPC.

42 miles, 10 inch, gas, from Rochester, Minn. to Winona and Goodview, Minn., $963,000, before FPC.

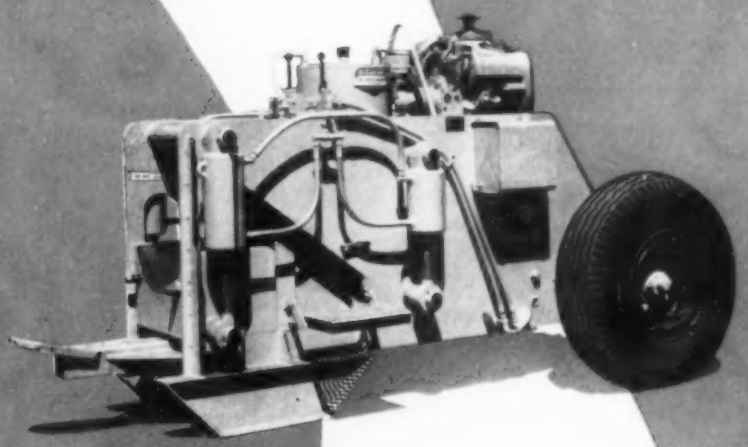
365 miles, gas, new facilities in Minn., Iowa, S. D., Neb., Wis., plus 1090 miles of branch line and station facilities, $65.7 million, authorization for a part. Gas facilities in Texas, Oklahoma and Kansas, $6 million, before FPC.

454 miles, main line loops and extensions, 6-30-inch, main line from St.

YOU CAN'T BEAT A CINCH



NEW CINCH VERTICAL MACHINE BENDS 6"-20" PIPE MORE EASILY AND ECONOMICALLY



• MOVES ANYWHERE — overall width only 6'8", mounted on toughest rubber tires • LIGHTWEIGHT — approx. 8400 lbs. complete with bending set • SIMPLE HYDRAULIC OPERATION — broken cable and other mechanical shutdowns eliminated, extra smooth bending power • SCRATCH-FREE, DEGREE-CONTROLLED BENDS — made closer to end of joint.

This new Cinch pipe bending machine already is in operation from coast to coast. Its hydraulic action gives it the extra power to bend quickly and smoothly ½-inch wall pipe up to 20" in diameter. Its light weight, compactness, bending power and simplicity are unmatched.

Crose offers two additional Cinch models for bending pipe 16"-30" and 22"-36" in diameter.

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Cloud, Minn., to Grand Forks, N. Dak., also 1,490 miles of branch lines, 2-10-inch, and station additions totaling 32,000 horsepower, $86 million, planned.

27.6 miles, 30-inch, gas, loop; 18.3 miles north of Beaver station in Okla., 9.3 miles north of Sunray station in Texas, $3 million, temporary FPC authorization.

Northwest Pipeline Corp., Salt Lake City, 350 miles, 6-10 inch, crude, from Four Corners area to Salt Lake City, $15 million, considered.

Ohio Fuel Gas Co., Columbus, Ohio, 56 miles, 18-24 inch, gas, Richland County, Seneca County, Sandusky County to Toledo area, $4 million, contract for 22 miles awarded to H. L. Gentry Construction Co.

33 miles, 4 to 20 inch, various counties, Ohio, $1 million, authorized.

21.8 miles, 12 and 20-inch, natural gas facilities in various counties, Ohio, $1 million, authorized.

Ohio Oil Company, Findlay, Ohio, 350 miles, 12 inch, products, from Wood River, Ill. to Chicago, 84 miles let to Panama-Williams Corp.

Pacific Gas & Electric Co., 1300 miles, gas, from Alberta, Canada to Antioch, Calif., $380 million, planned.

Pacific Northwest Pipeline Corp., Salt Lake City, 235 miles gas, gathering lines in San Juan Basin, Garmesa, Piceance Creek, and Big Piney Fields, $13.5 million, planned.

65 miles, gas, sales laterals in Washington, $1.5 million, planned.

52 miles, 30-inch loop Big Piney, Wyoming, gathering system, $5 million, planned.

Panhandle Eastern Pipe Line Co., Kansas City, 33 miles, 16 inch, gas, Muncie, Ind., lateral, planned.

Pennsylvania Gas Co., Warren, Penn., 38 miles, 8 and 10 inch, gas, in Erie and Warren Counties, Penn., and Chautauqua County, N. Y., $2.6 million, authorized.

Permian Basin Pipeline Co., Omaha, Neb., 26.8 miles, 10 inch, gas, from a point on existing system in Pecos County, Texas, to a gasoline plant, $787,100, authorization.

Piedmont Gas Co., Hickory, N. C., 78 miles, 2-8 inch, gas, from connection with Transcontinental Gas Pipe Line to serve customers in North Carolina, $2.6 million, authorized.

Shell Pipe Line Corp., Houston, 100 miles, 18-20 inch, crude, from Shell's Southwest Pass terminal to Shell's Norco Refinery near New Orleans, $10 million, planned.

Southern Kansas Pipe Line Co., Inc., Arkansas City, Kansas, 200 miles, 6-10 inch, crude, southwestern Kansas to Arkansas City, Kansas, planned.

Southern Natural Gas Co., Birmingham, 69 miles, 24 inch loop, gas, along the east leg of the Louisiana supply system between Toca and Franklinton compressor stations; 67 miles, 26 inch loop, gas, from Franklinton to Gwinville, La., to bring gas from 12 fields on south Louisiana to main system at Gwinville, $37.5 million, before FPC.

Tennessee Gas Transmission Co., Houston, 632 miles, 24 and 30 inch, gas, from Louisiana delta to Portland, Tenn. and Coudersport, Pa. to Hamburg, N. Y., temporary FPC authorization.

264 miles loop lines in Tennessee, Kentucky, West Virginia and Pennsylvania, temporary FPC authorization.

Compressor stations in Mississippi, Tennessee, New York, Pennsylvania and additions in Tennessee, Kentucky, Ohio and Pennsylvania, $129 million, temporary FPC authorization.

Texas Eastern-Penn-Jersey Transmission Corp., Shreveport, La., 65 miles, gas, from Delmont, Penn., to Lambertville, N. J., before FPC.

24,000 compressor hp additions to existing stations, $4.4 million, temporary FPC authorization.

Texas Eastern Transmission Corp., Shreveport, La., 267 miles, 14-30 inch, gas, Louisiana, Mississippi, Pennsylvania and New Jersey, $50 million, before FPC. 59 miles, 30-inch, gas, loop additions to pipe line from Kosciusko, Miss. to Uniontown, Penn., $5.8 million, temporary FPC authorization.

96.5 miles, 30-inch, gas, between Kosciusko, Miss., and Uniontown, Penn.; 9.4 miles of supply laterals; a 10,250 hp compressor station, and 33,360 hp to existing compressor stations, $24.5 million, authorized.

Texas Eastern Transmission Corporation and Wilcox Trend Gathering System, Inc., gas, compressor stations, $4 million, authorized.

Texas Gas Gathering Corp., Shreveport, 36.6 miles, gas, gathering system in Rodney Field, Jefferson County, Miss. and from North and South Locust Ridge, Lake St. John Field in Tensas and Concordia parishes, La., $855,413, Before FPC.

Transcontinental Gas Pipeline Corp., Houston, 87 miles, 24 inch, and 56 miles, 6-10 inch, gas, gathering systems, Southeastern Louisiana, $14 million, before FPC.

202 miles, 36-inch, gas, loops, 106 miles, 30-inch, three new compressor stations totaling 24,084 hp, additions at five stations totaling 12,000 hp, 195 miles, 24 and 30-inch, gas, across Pennsylvania to Leidy Storage Field, purchase laterals of 8-20 inches in South Louisiana and offshore, and a new river crossing to serve New York. $126.8 million, before FPC.

Trans-Western Pipe Line Co., Dallas, 800 miles, 30-inch, gas. Four Corners area to California, $200 million, planned.

Underground Storage & Exploration, Upper Darby, Penn., 394 miles, 12-inch LPG, from Moundsville, W. Va. to Newark, N. J., $9 million, approved.

95 miles, 6-8 inch, laterals to Mauch Chunk, Penn., and to Philadelphia, planned.

United Gas Pipe Line Co., Shreveport, La., 203 miles, 30-inch, gas, between New Orleans and Mobile, Ala., $33.7 million, before FPC.

International

ACT Oils, Ltd., Montreal, 400 miles, crude, Dawson Creek, B. C., to Bella Coola, B. C., before B. C. government.

Alaska-Yukon Refiners and Distributors, Ltd., Edmonton, Alta., 150 miles, products, serving Alaska and Yukon territory, $3.5 million, planned.

Bituminous Oil Pipeline Co., Calgary, 25[illegible] miles, crude, from Athabasca tar sand plant in northeastern Alberta to Edmonton, approved.

British Petroleum Co., New York, 60 miles crude, from deep water tanker termina at Milford Haven, U. K. to Llandarcy Refinery, $18 million, planned.

Burmah Oil Co., Ltd., 850 miles, crude 20 inch, from Nahorkatiya to Calcutta India, planned.

Cie. de Recherche et d'Exploration de Petrole au Sahara, 530 miles, 16 inch crude, Edjele field in Algeria to a port on Libyan coast, planned.

Consolidated Gathering Systems, Ltd., Calgary, 198 miles, crude, Sturgeon field to Edmonton, planned.

Cuban Gas Transmission Co., 650 miles, gas, from Campeche area of Mexico across Yucatan and under Gulf of Mexico to Havana, Cuba, 120 miles would be submarine, considered.

Development and Resources Corp., 70 miles, 8 inch, gas, from Agha Jari oil field to Ahwaz, Iran, planned.

East Coast Transmission Co. (Pacific Petroleums, Ltd., Home Oil, Ltd., Canadian Homestead Oil, Ltd. and Merrill Petroleums, Ltd.), crude, from Alberta to Toronto, planned.

Elburz Oil Corp., 1000 miles, big inch, crude, from Central Iran to Alexandretta, Turkey, $450 million, planned.

Entre Nazionali Idrocarburi, Rome, Italy, crude, from Qum field in Iran to the Mediterranean Sea, considered.

Hydrocarbons Pipeline, Ltd., Winnipeg, Manitoba, 880 miles, 6-8 inch, products, from Edmonton to Winnipeg, $35 million, partial authorization.

Iraq Joint Venture Pipe Line, 1200 miles, 38-40 inch, crude, from head of Persian Gulf through Iraq to Turkish coast of Mediterranean, $840 million, planned.

Iranian Consortium, 22 miles, 16 inch, and 30 miles, 16 inch, crude, from Agha Jari field to Bandar Mashur, planned.

Mene Grande Oil Co., 42 miles, 16 inch, crude, from Ceuta field in Lake Maracaibo to Bachaquero terminal, $6 million, planned.

76 miles, 30 inch, from Oficiana to Puerto La Cruz, Venezuela, considered.

61 miles, 6 inch, LPG, from Anaco to Puerto La Cruz, Venezuela, considered.

National Iranian Oil Co., 146 miles, 6 inch, crude, from Azna to Isfahan, Iran, $5 million, planned.

1000 miles, 38 inch, crude, from central Iran to the Turkish Mediterranean coast, considered.

Northern Utilities Co., 35 miles, 16 inch, gas, in Fremont Natrona County, Wyo., area; 8 miles, 12 inch, around Casper; 6 miles, 8 inch, from Sand Draw gas field to Beaver Creek field; 12 miles, 6 inch, from Beaver Creek field to the sys-

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New Shand and Jurs model ST-9749 diaphragm-type breather valves are a major achievement in storage tank venting and vapor conservation.

They provide resistance to sticking, corrosion and freezing never before offered. In addition they require practically no maintenance feature non-wetting teflon-on-fiberglas diaphragms for maximum performance and longer life; completely eliminate critical drain holes or other areas that require continuous checking. Ruggedly built from aluminum and stainless steel, ST-9749 breather valves are lightweight, and already available in 4", 6", 8", and 10" sizes. Call your nearest S&J branch office or sales representative for Technical Bulletin 52D-ST-9749 Breather Valve.

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tem servicing the Riverton-Lander area, planned.

Northwestern Utilities, Ltd., Edmonton, 7[illegible] miles, 16-inch, gas, from Pembina field to Edmonton, $3.5 million, approved.

Petroargentina, Bahia Blanca, Argentina, 370 miles, 16 inch, crude, from Neuguen to Bahia Blanca, Argentina, $40 million, planned.

Petroleos Mexicanos, 108 miles, 10 inch, gas, from Gral. Escobedo to Monclova to tie into Reynosa-Monterrey gas pipe line, $9 million, planned.

600 miles, 24 inch, gas, from Pemex City to Mexico City, $50 million, planned.

38 miles, 4 inch, products, from Mexico City of Toluca, $500,000, planned.

126 miles, 4, 6 and 8 inch, products from Mexico City to Cuernavaca and Puebla, $2.5 million, planned.

Royal Dutch Shell Co., 155 miles, 24-30 inch, crude, from German Rhineland to mouth of Rhine River, planned.

Saskatchewan Power Corp., Regina, Sask., 80 miles, gas, Hatton gas field to Success, Sask., planned.

40 miles, gas, Moose Jaw to Regina, Sask., planned.

Stanmount Pipe Line Co., 140 miles, 10 inch, crude, Cayiga and Beaver Lake fields, N. D., to connect with Interprovincial Pipe Line, planned.

Sturgeon Pipe Line Co., 100 miles, 12-inch, Sturgeon Lake field to Trans-Mountain system, $6.5 million, planned.

Sui Gas Transmission Co., Multan, Punjab, India, 145 miles, 8-inch, gas, from Sylhet to Dacca, East Pakistan, $9 million, considered.

83 miles, 10-inch, gas, from Rohri section headquarters of Sui-Karachi line to main Multan line on East bank of Indus in the Bhung vicinity, Pakistan, planned.

Trans-Europe Pipe Line, 700 miles, 30 inch, main trunk, crude, from Mediterranean to northern Europe, considered.

Trans-Mountain Oil Pipe Line Co., 100 miles, loops near Kamloops, B. C. and Edson, Alta. plus pump station, tank farm and three temporary stations, $40 million, 50 miles let to Dutton-Williams Bros.

Westcoast Transmission Company, Ltd., 174 miles, 30-inch, gas, Savanna Creek gas field, Alberta, to British Columbian border, $45 million, planned.

650 miles, crude, from Peace River area to Vancouver, $100 million, planned.

Winnipeg and Central Gas Co., Winnipeg, Mant., 450 miles, 4-8 inch, LPG, from Tioga, N. D. to Winnipeg, Canada, $20 million, planned.

Yacimientos Petroliferos Fiscales, Buenos Aires, Argentina, 621 miles, 12-inch, products, Mendoza to San Lorenzo, Argentina, $19 million, planned.

281 miles, 12¾ inch, crude, Pichanal to San Miguel Tucuman to Techint, S. A., planned.

ALL AROUND PROTECTION FOR PIPELINES IN CASINGS

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For Gathering and Distribution Pipelines

WITH FOUR POINTS OF ADJUSTMENT . . . THINSULATOR FITS BARE OR COATED PIPE (4" & smaller have two joints)

EASY PULL THROUGH CASING

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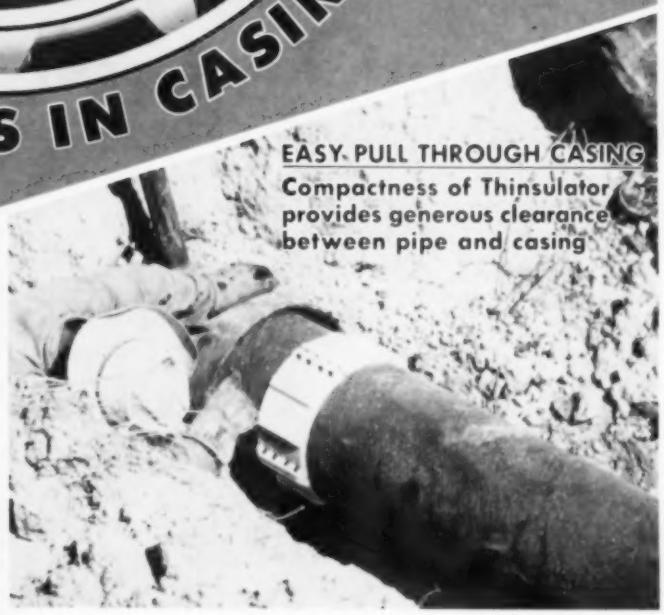

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How to do it

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas

Corrosion Test Section Employs Coupons and Test Spool To Determine Rate of Corrosion in Sour Crude Pipe Lines

Corrosion in sour crude pipe lines usually occurs along the bottom of the pipe. Most test coupon installations do not take this into account. When the coupon is suspended in the pipe, only a small portion is in the proper position to measure the corrosion rate. Corrosion is caused by water and scale dropping out of the oil and collecting in low places. To properly check the rate of corrosion of the pipe, the coupon must be in this area.

Another disadvantage of coupons suspended in the line is that they interfere with the running of scrapers. In order to run a scraper, all coupons must be removed. This can be a time consuming procedure if a number of locations are being checked. Also, not being in the line during the scraping, the coupon does not receive the same treatment as the pipe.

One company has minimized many of the problems by a specially designed corrosion test loop. Provision is made for four coupons, recessed in the bottom of the pipe, and for a 3-foot calibrated test spool. Short term corrosion rates are determined from the coupons. A more accurate trend can be determined from the test spools. Accurate predictions of service life of the pipe line have been made from data collected from examination of the test spool.

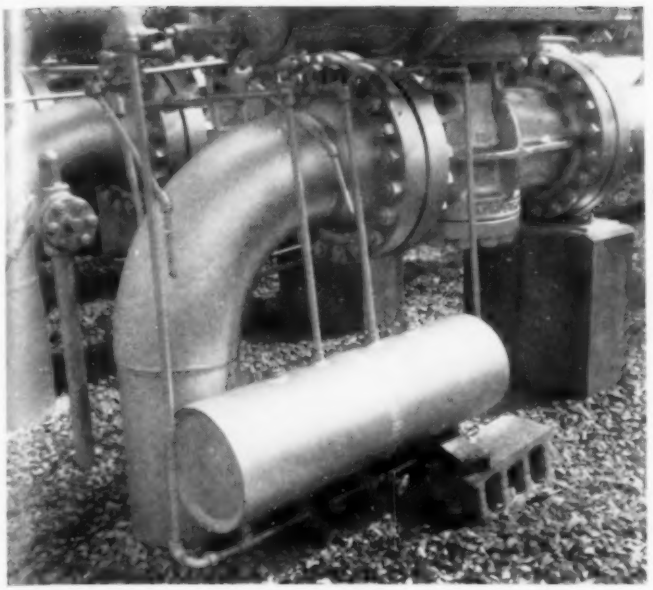
In order to let the coupons be flush with the bottom of the pipe, a window is cut in the bottom of the test section. A piece of half-wrap is welded over the window and pins installed to hold the coupons. Two nipples with blanking flanges are installed on the top of the pipe directly over the coupon positions. Using blanking flanges makes it possible to change or examine the coupons with no special tools other than a sledge or ball peen hammer.

The coupons are fabricated from mild steel with a hole in one end to fit over the pin in the bottom of the pipe. Coupons are bent to the radius of the pipe, permitting a flush fit with the bottom of the pipe. All coupons are protected on the convex side with a plastic coating allowing only one surface to be exposed to the corrosive action. Before applying the coating, the coupons are accurately weighed with the weight and number being recorded. After the coating is applied the coupons are sent to the field in sealed containers to preserve the sand-blasted surface.

When the period of exposure is completed, the coupons are returned to the laboratory, cleaned of scale and corrosion products, the coating on the underside removed and the weight recorded. Coupons are also visually examined for pits and the pits measured with a pit gage.

Test spools are calibrated and examined for any imperfections before being installed. Spools are installed in the line with mechanical couplings. After exposure they are checked for pitting and the depth of the pits are measured.

Where the line to be checked operates continuously and cannot be shut down to change the coupons, a bypass is installed. This permits free access to the test section without having to shut down the line. The test section can be used to check the effectiveness of inhibitor or scraper programs, as well as to check the corrosion rate of a new line to determine the desirability of instituting some corrosion preventive measure.



Pot Aids Hydraulic Valves Operating on Air Controls

Where remotely controlled valves are operated by hydraulic pressure, but the plant is set up on air or gas controls, the valves are difficult to adjust to prevent rapid closing or opening when air is used in place of hydraulic fluid.

One pipe line station superintendent overcame this problem by placing a pot at the base of the valve, filling it with hydraulic fluid, with the outlet to the valve welded to the bottom of the pot. The air control line is tied into the top of the valve.

When the air is turned on, the hydraulic fluid is forced out the bottom to operate the valve. As soon as the air pressure is turned off, the oil will again fill up the vessel, allowing the valve to close.

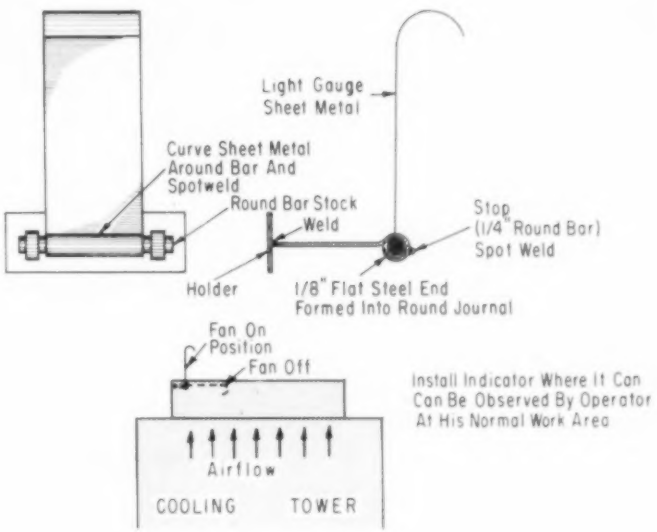
Shown is a two-valve hookup where two valves are operated from the same vessel. The metal container is divided by a wall making it two separate vessels.

Indicator Placed Above Fan Can Be Seen From Distance

When a forced-draft cooling tower is operating, it is necessary to check from time to time and see if the fan is operating. Unless some indicator is wired into the electric system and the indication appears on a board, it is necessary for the operator to leave his work zone periodically to check the fan. Such a warning light is an expensive item.

A simple indicator can be made which will show the operator at a considerable distance that the fan is working. This indicator is installed above the fan. It should be in a place where it can be easily seen from the work area.

Construction of the indicator is such that when the fan is operating the force of the blower will make the indicator stand in a vertical position where it is visible from below. When the fan is idle, the indicator will fall into a horizontal position and will not be visible.

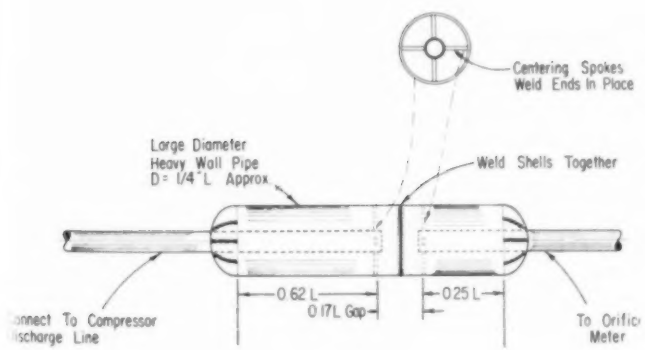

Light Gauge Sheet Metal
Curve Sheet Metal Around Bar And Spotweld
Round Bar Stock
Weld
Stop (1/4" Round Bar) Spot Weld
Holder
1/8" Flat Steel End Formed Into Round Journal
Fan On Position
Fan Off
Install Indicator Where It Can Can Be Observed By Operator At His Normal Work Area
Airflow
COOLING TOWER

Pulsation Damper Creates Smooth Gas Flow Condition

When reciprocating type compressors cause the gas flow to be jumpy and jerky, a pulsation damper, fabricated as shown in sketch, and installed in the discharge line of the compressor station, will help absorb the roughness and create a smoother condition of gas flow.

If the discharge gas from the compressor is to be measured by an orifice meter, such a pulsating flow is frequently desirable for obtaining smooth lines on the meter chart.

The pulsating snubber is made of steel and fabricated by a welder, as shown.



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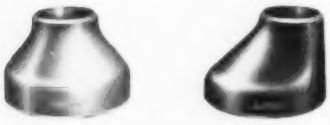

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Complete encirclement saddles.

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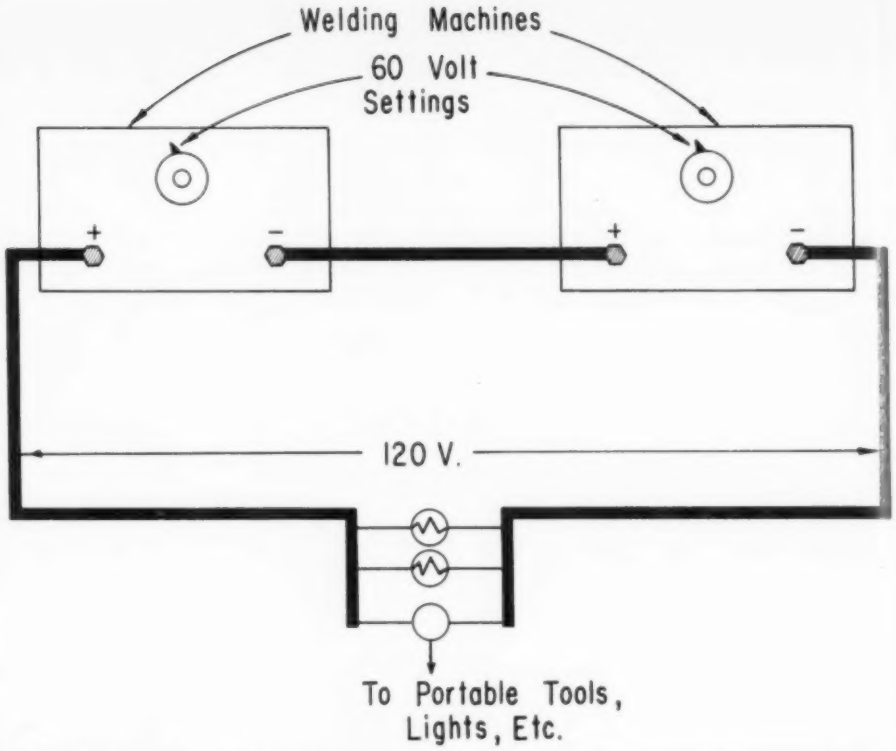

Welding Machines Serve As Electric Power Supply

If there is ever a pipe line or station emergency which leaves you without lights or electric power, two welding machines can be used as a supply source.

Connecting the machines together, with 60-volt settings, will give you a 120-volt power supply. This station will provide lighting or electricity for tools with universal motors. The source of power is also good for heating.

Bend in Tong Handle Facilitates Pipe Laying

Where it is necessary to lay and take up temporary lines around the station, a bend in the tong handle will greatly facilitate "cranking up" and unscrewing the joints of pipe.

As soon as the pipe is stabbed into the joint straight, the tong is slipped in and the joint spun to where it is usually tight enough for water lines or temporary gas lines.

When it is necessary to take up the line, the pipe is put on a grower board and the tong put on left-handed. Pipe is quickly spun out of each joint.

Grease Connections to Make Locks Weatherproof

Where equipment for cathodic protection is housed along the pipe line locks need protection against the weather. One foreman got the idea of keeping the locks full of grease

How Tractor Type Crawlers Speed Pipeline Trenching

Some 3 million yards of blasted rock, conglomerate, and dirt are moved in construction of a 256-mile natural gas line in Arizona. The going is rough — up and down steep grades. Three Bucyrus-Eries, including the one shown here, were used on the spread.

Optional tractor type crawlers, available for the ½-yd. 15-B and the ¾-yd. 22-B, provide extra clearance for travel over rocks, stumps, and most other obstructions you might run into. You keep trenching. There's little time lost to clear the way. Shoes have deep grousers for sure traction in soft ground and for climbing steep grades. No need to hitch on to another machine for help up hills or through muck. You keep *all* your machines busy making money.

Look over the jobs pictured. See how Bucyrus-Eries with tractor type crawlers trench through hilly country, in water and muck, amid rugged forest terrain. Then see your nearby Bucyrus-Erie distributor for a complete rundown on these machines. You'll find out why these money makers have become the trenching favorites with pipeline contractors all over the country. 529E58

BUCYRUS ERIE

A Familiar Sign at Scenes of Progress

BUCYRUS-ERIE COMPANY • SOUTH MILWAUKEE, WISCONSIN

Working 10 hours daily, 7 days a week, this 22-B demonstrated its ability to stay on the job come mud or high water — even a trench full of water as shown. It was one of two Bucyrus-Erie hoes used to trench for a natural gas pipeline across northern Pennsylvania.

When all the hoes on your spread are Bucyrus-Erie you get top performance all the way through. That's why many pipeline contractors are switching completely to Bucyrus-Eries. Here are two of the three Bucyrus-Eries that were used to trench for a natural gas line running across Pennsylvania, New Jersey, New York State, and into New England. They are shown working in a rough, heavily wooded area near Milford, Pa.

Now from FORD

New Ford C-1000 with the 260-hp. 477 Super Duty V-8 engine. Maximum GVW 31,000 lb., GCW 65,000 lb.

New Ford T-850, choice of 3 engines. Choice of 2 bogies, up to 45,000 lb. GVW and 70,000 lb. GCW.

New Ford F-1100 with the 277-hp. 534 Super Duty V-8 engine. Maximum GVW 36,000 lb., GCW 65,000 lb.

AMERICAN BUSINESS BUYS MORE FORD TRUCKS THAN ANY OTHER MAKE!

engines up to 534 cu. in...

Biggest truck engines ever built by Ford! Three all-new, Super Duty V-8's designed to stand up and deliver on America's toughest truck runs. 401-, 477- and 534-cu. in. displacements. Up to 277 hp.! Ten all-new extra heavy duty truck series rated up to 75,000 lb. GCW.

Perhaps the biggest news about Ford's all-new Super Duty V-8's is not their bigness . . . not their tremendous power output. The big story may well be in the many durability advancements, offered in the most rugged, most dependable Ford Truck engines ever built.

For instance, materials developed for the missile program are used in parts such as valve stem oil seals. Oil filters are of the same type used in commercial aircraft. The traditional exhaust-heated intake manifold is replaced by a new water-jacketed induction system. Submerged-type electric fuel pumps virtually banish vapor lock. Head gaskets are of heat-resistant stainless steel. Two compression rings and the oil control ring are chrome-plated for longer wear. A 50-amp. alternator replaces the generator as standard equipment.

These are but a few of the many advancements you'll find in Ford's thoroughly tested all-truck Super Duty V-8's for 1958. Tested in dynamometer laboratories, tested on the proving grounds, tested in commercial fleets from coast to coast . . . these new Ford V-8's, products of over six years of engineering development, are now ready to serve you.

Get in touch with your Ford Dealer for complete data on the three all-new Super Duty V-8's, and the *ten* all-new Extra Heavy Duty truck series, including tandems up to 51,000-lb. GVW, 75,000-lb. GCW, single-axle trucks up to 36,000-lb. GVW, 65,000-lb. GCW.

NEW! Three all-new engines—*401* cu. in. V-8 develops 226 hp., 350 lbs.-ft. torque . . . *477* cu. in. V-8 develops 260 hp., 430 lbs.-ft. torque . . . *534* cu. in. V-8 develops 277 hp., 490 lbs.-ft. torque.

NEW! Water-jacketed induction system contributes to maximum power output with excellent economy by providing more positive temperature control of fuel-air mixtures.

NEW! Fully machined combustion chambers and Turbulence-top pistons provide more accurate compression control and greater fuel-air turbulence, for top performance with regular grade fuel.

NEW! Submerged-type electric fuel pump virtually eliminates vapor lock. Pump delivers only solid fuel, always under pressure, operates independently of engine speed.

NEW! Valve seat inserts for intake as well as exhaust valves. Intake valves are hard-faced dished-type. Exhaust valves are sodium-cooled, faced with tungsten-cobalt.

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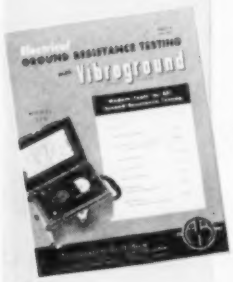

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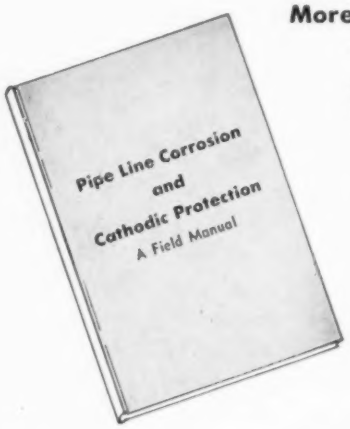

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This Handbook, written by Marshall E. Parker, consultant, is designed as a practical field manual. It is a 108-page pocket-size volume printed first as a popular series in WORLD OIL. The Handbook is illustrated with many charts and drawings and is completely indexed by subjects.

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simply by putting an alemite connection on a drilled and tapped hole on the side.

He placed a hole near the keyhole so that the grease would start to come out the keyhole then fill up the lock and come out around the hasp. He had no more trouble with locks corroding, and one greasing per year was sufficient. The grease has a pour point above 110° F., therefore there is no chance for the grease to run out during hot weather.

New Design Protects Truck Mud Flaps in Ditch or Woods

Truck mud flaps can be damaged easily when one is working in the woods or on a ditch bank, but a new design helps to protect the flaps.

Mount 3-T hinges on the back side of the flap and attach a strip of 1/16 inch steel on the front side to act as a washer. Bolt or weld the "T" hinge to the bed of the truck to allow the flap to work back and forth instead of bending or breaking.

On bottom of the flap attach two strips of 1/16 inch steel about one-inch with five stove bolts. On the center bolt attach a loop made of light tin with a small ring in the loop. Then mount a hook on the underside of the truck bed so that the mud flaps can be folded up and the ring slid over the hook. This holds the mud flaps out of the way when working in the woods or on ditch banks.

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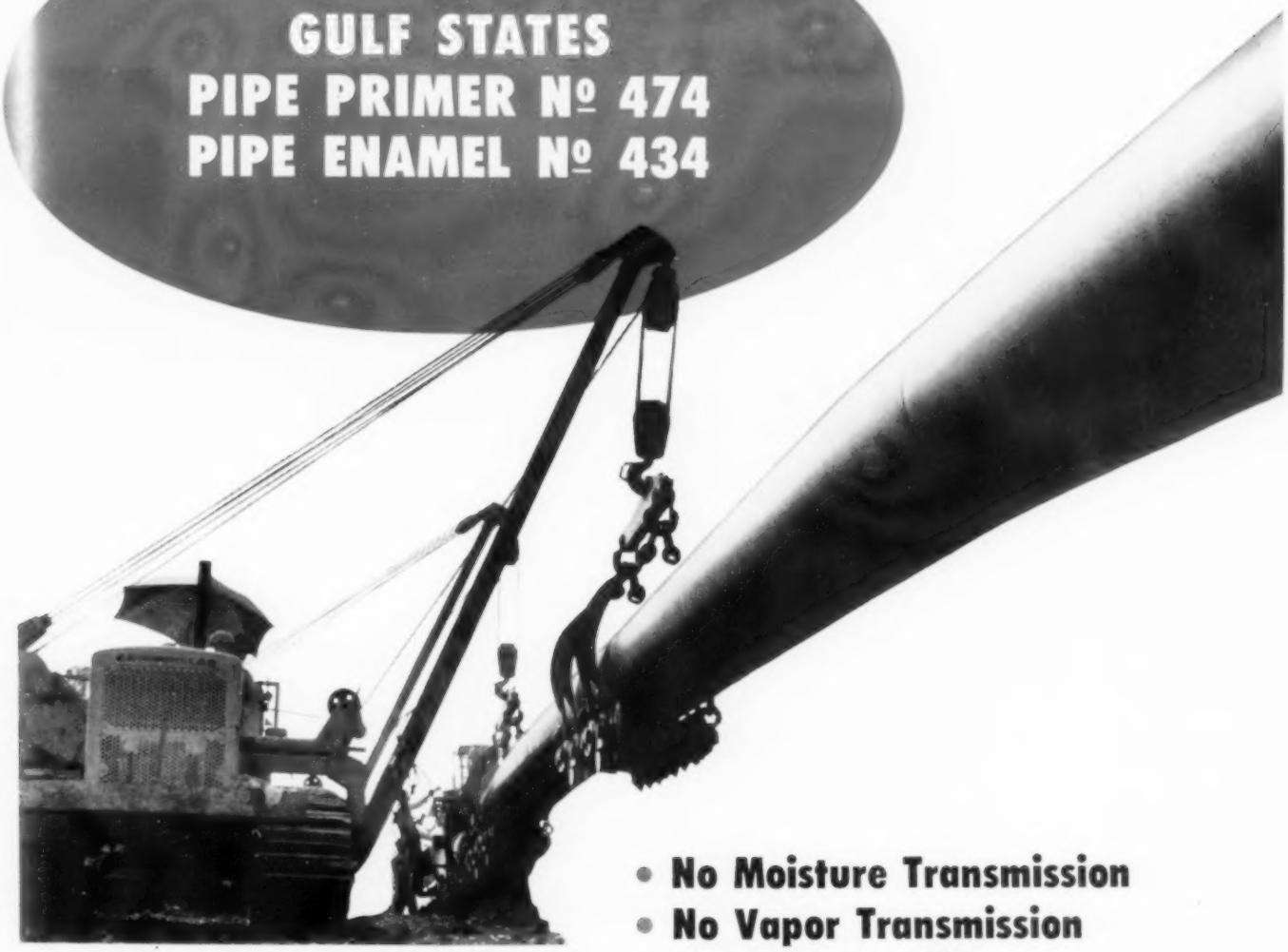

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What's Happening

among MEN in the INDUSTRY

A. B. Dilworth

M. L. Mead

Northern Natural Gas Company announces the appointments of **A. B. Dilworth, M. L. Mead and W. L. Shoemaker** as senior vice presidents. The three vice presidents will also compose the executive and policy committee for the company's management board.

W. L. Shoemaker

Dilworth and Shoemaker have been associated with Northern Natural since 1930 and Mead joined the company in 1931. Dilworth will be concerned with policy areas related to increased earnings per share for stockholders and to decreased costs of gas to consumers, Mead will give particular attention to the policy areas of research and diversification, and Shoemaker will devote his services to broad top-level areas of public relations and related fields.

•

Charles A. Sweningsen has been appointed manager of the newly formed Construction department of **Southern Counties Gas Company.** Also promoted were **John McCollum**, as supervisor, construction procedures; and **Frank Messersmith,** supervisor, construction quality. Sweningsen, formerly a construction engineer, has been with the company since 1947.

•

Charles B. Towill has been appointed public relations representative for the **Fifth World Petroleum Congress, Inc.** with headquarters in New York City. Towill was formerly manager of public relations for Iranian Oil Participants Limited in London. The Congress will open in New York Coliseum, May 31, 1959.

•

Westcoast Transmission Company has appointed **D. P. McDonald,** managing director. McDonald also serves as vice president and chief counsel for Westcoast. His new position makes him responsible for the overall operations of Westcoast's pipe line systems. McDonald has served as a counsel for many independent oil companies and joined Westcoast as counsel in 1949.

•

J. W. Ferguson has been promoted to director of natural gasoline and gas operations for **Continental Oil Company.** Establishing headquarters at Houston, Ferguson succeeds **C. L. Ritter,** who transferred to Constock Liquid Methane Corporation, New York City, a Conoco affiliate. Ferguson began his Conoco career in 1952 as a senior analyst in Coordinating and Planning department. He moved up to assistant manager in 1953 and became director of Economics and Statistics division in 1956.

•

Pipe Line Service Corporation named **Jay E. Thompson** vice president and a member of the board of directors of the company. Thompson, who joined the company in 1957, had been with Standard Oil Company (New Jersey) since 1946 working five years with a subsidiary, Creole Petroleum Corporation, in Caracas and Tia Juana, Venezuela as a pipe line engineer.

•

W. C. Kinsolving, president of Sun Pipe Line Company and Sun-Canadian Pipe Line Company, has been named a member of the board of directors of the **Fifth World Petroleum Congress, Inc.,** to be held in May, 1959. Kinsolving will handle the Congress' Transportation and Distribution section.

W. C. Kinsolving

He has been president of the company since 1947 and with the organization since 1923. Kinsolving is also a director of Mid-Valley Pipeline Company, West Texas Gulf Pipe Line Company and Detroit Southern Pipe Line Company.

•

Raymond F. Hadley, chief engineer of the Product Lines department, has been appointed to the additional post of vice president of **Sun Pipe Line Company.** Hadley, a specialist in corrosion control, was one of the first to study the process of anaerobic microbiological corrosion. In 1940 he was awarded the Beal Medal of the American Gas Association for his research work. Hadley has been associated with the company since 1931 when he joined **Susquehanna Pipe Line Company,** then a subsidiary of **Sun Oil Company.**

•

James C. Saks

H. Dix Fowler

H. Dix Fowler is the new vice president in charge of engineering and operations, and **James C. Saks** has been appointed sales manager of **Trans-Canada Pipe Lines Limited.** Fowler came to Trans-Canada in 1954 as a supervising engineer and was appointed assistant chief engineer in 1956. He was with Gulf Interstate Gas Company before joining Trans-Canada. In his new position Fowler has charge of engineering, construction and operation of the 2294-mile Alberta to Montreal line.

Saks started with Trans-Canada in 1954 as assistant to the president and assistant secretary of the company. In 1955 he was appointed manager of gas supply in the Calgary office. Prior to his work with Trans-Canada, he was publisher of the Western Oil Examiner.

•

Pan American Petroleum Corporation has appointed **Bryan C. Edwards** Canadian division gas superintendent. Edwards has been with Pan American since 1947. In 1956 he moved to Calgary as senior sales engineer for Pan America's natural gas production in Alberta.

•

C. R. Carrothers of **Humble Pipe Line Company** has been elected president of the Gulf States Chapter of the American Right of Way Association. Vice presidents selected include **Glen F. Graves, Trunkline Gas Company,** Houston; **J. R. Ball, Magnolia Pipe Line Company,** Dallas; **Paul E. Lirette,** Department of Highways, Louisiana; **William F. Howard, El Paso Natural Gas Company** and **Hood Kizziar, The Texas Pipe Line Company,** Houston.

•

Richard W. Scott has been elected vice president of **Republic Natural Gas Company.** During the past 10 years Scott has been associated with **Warren Petroleum Corporation** as manager of exploration. Formerly he had been with the **ITIO Company** and **Cities Service Oil Company.**

•

Walter E. Biery has been named president of the **Mid-Continent Pipe Line Co** succeeding **J. Marston Linehan.** Linehan who has been with the pipe line company since 1933, resigned to become vice president and manager of crude oil supply and

Now... controlling vegetation is easier-cheaper-

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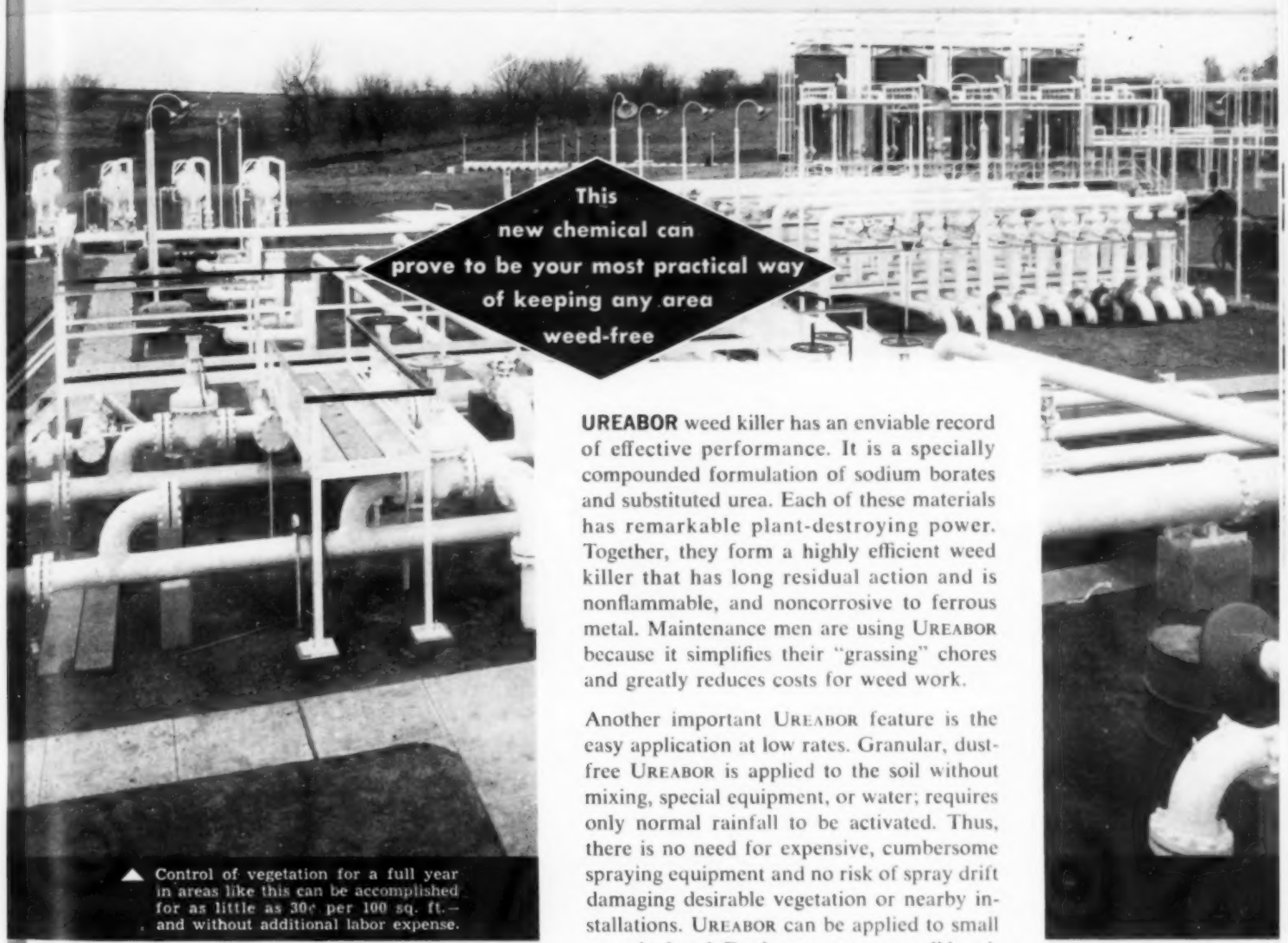

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transportation for Sunray Mid-Continent Oil Co. and D-X Sunray Oil Co.

Others elected to the board of directors include **O. E. Bryant, Fred E. Pyeatt, Jr., M. C. Jones** and **J. H. Woodard.** Bieby has been with Mid-Continent since 1944 and was named vice president and general manager in 1957.

•

W. E. Graham

E. T. Robinson

Texas Eastern Transmission Corporation announces three appointments in its Natural Gas and Little Big Inch divisions. **E. T. Robinson, Jr.,** moves up to general superintendent of the Natural Gas division, placing him in charge of operations of pipe lines and compressor stations, gas measurement, corrosion control and dispatching functions.

W. Earnest Graham assumes the position of administrative manager, and **Jamie T. Irvine** is the new general sales manager for the Little Big Inch division. Robinson has been with Texas Eastern since its inception in 1947 and was made assistant general superintendent in 1954. Graham formerly had been vice president of the Philzona Petroleum Company and a company director since 1956.

•

Howard W. Blauvelt has been elected senior vice president of **Hudson's Bay Oil and Gas Company, Ltd.,** a subsidiary of **Continental Oil Company. J. B. Cecil** has been promoted to assistant controller of Continental Oil succeeding Blauvelt. Blauvelt has been with the company since 1952 and Cecil since 1951.

•

Natural Gasoline Association of America appointed **Ronald E. Cannon** as its new secretary and **William F. Lowe** executive director and treasurer. Lowe had been the Association's secretary-treasurer since 1934.

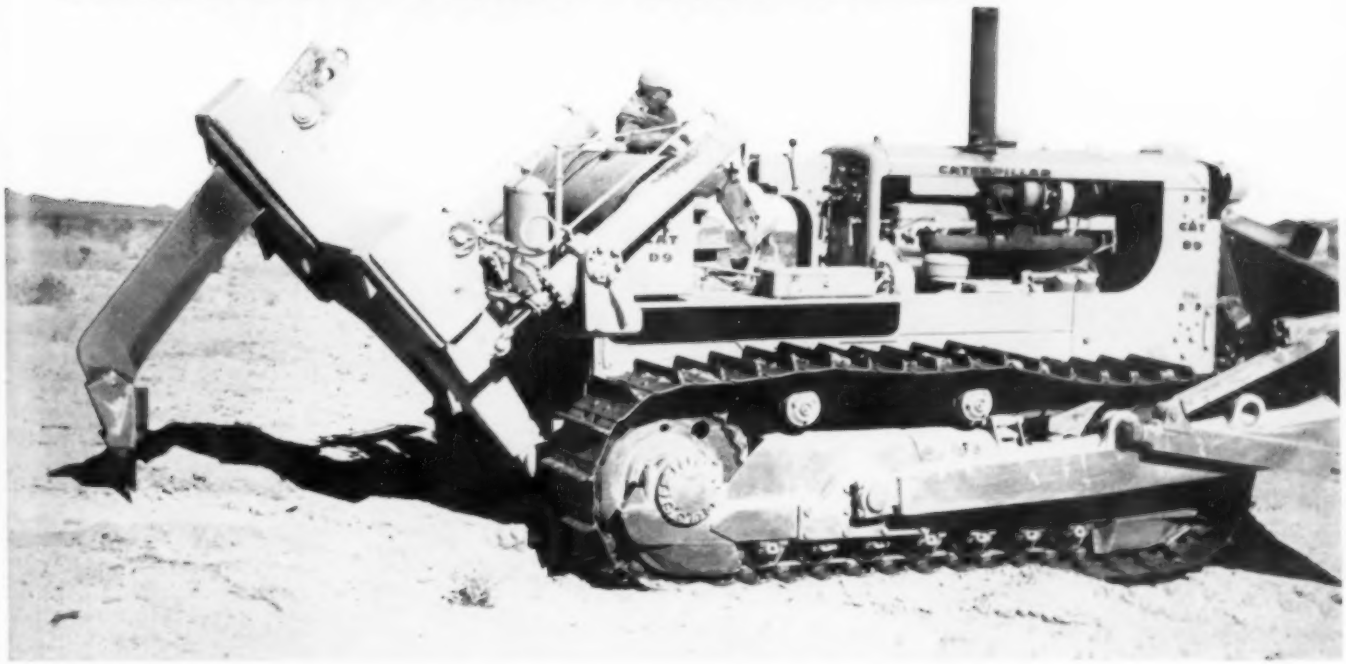
Ronald E. Cannon

Cannon, previous to his new appointment, was a technical editor for the McGraw-Hill Publishing Company of New York. In 1943 Cannon joined Gulf Oil Corporation as a project engineer and served in refineries at Port Arthur, Texas and Philadelphia.

•

Willis A. Strauss has been promoted to administrative vice president of **Northern**

RIPS DEEPER
THROUGH FROST AND ROCK



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C-R-C Kelley Coal Ripper shown making a pass through a strip mine. Penetration depth is a maximum 7 feet.

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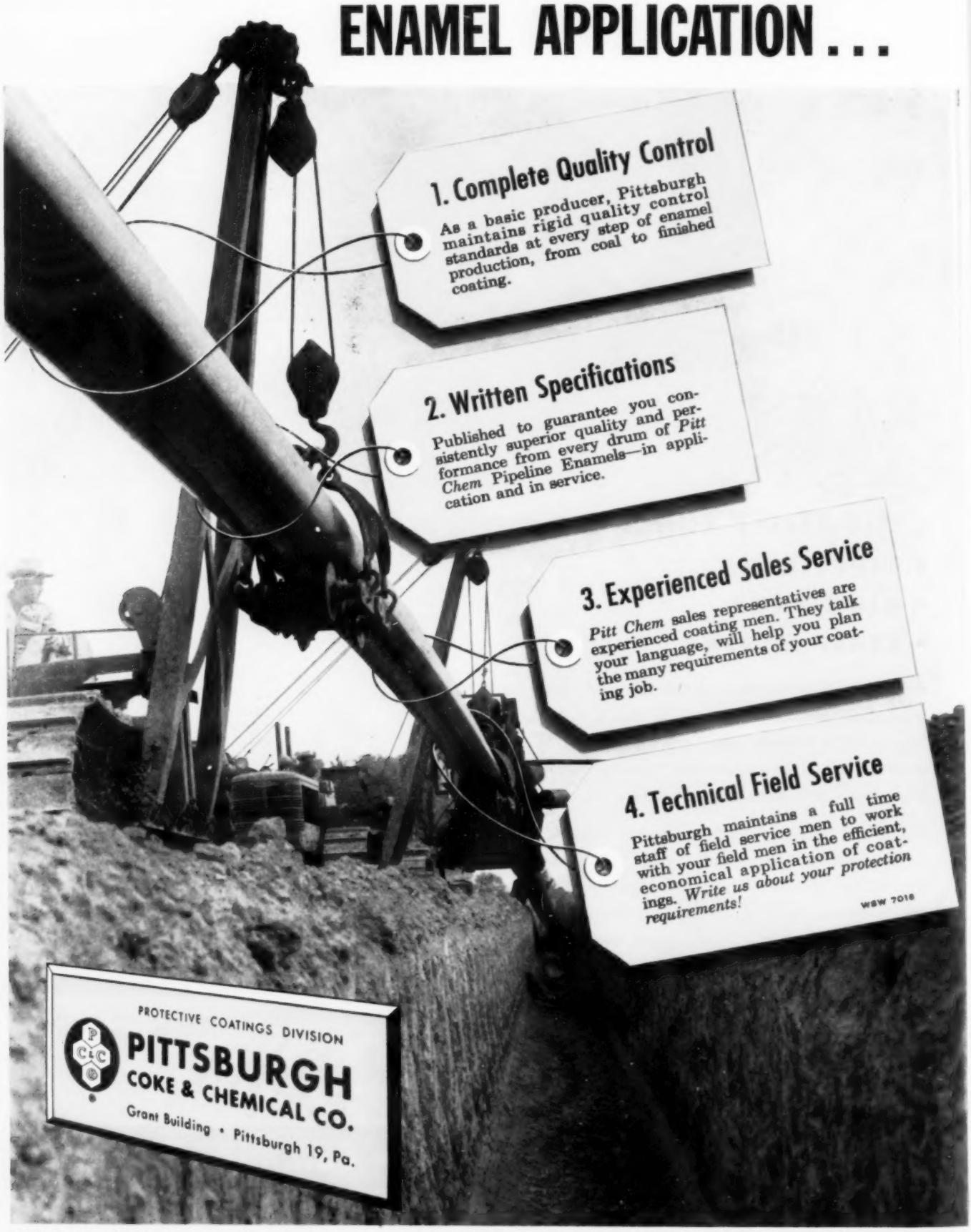
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Natural Gas Company. Prior to his new appointment Strauss had been director of the company's Certificate department. He joined the company in 1948 in the Engineering department. He was promoted to staff assistant of the General department in 1951; he became administrative assistant in 1952 and in 1953 was named director of the Certificate department.

•

George W. Goad

John W. Gendron

Tidewater Oil Company has made two administrative promotions. **John H. Gendron** is now administrative assistant to the president and **George W. Goad** has been named manager of the company's Oil Purchase and Exchange department.

Goad, who succeeds Gendron in his new position, previously had been manager of Tidewater's Crude Oil department in the Southwest. Gendron is also a vice president and director of **Tide Water Iran, Ltd.**, and director and vice president of **Iricon Agency, Ltd.** Gendron joined Tidewater in 1946 and Goad has been with the company since 1929.

•

Carl C. Whitaker, formerly construction supervisor, has been appointed superintendent of operations for **Trans-Canada Pipe Lines Ltd.** Whitaker will be responsible for operation managers in the Fields, Construction Operations, Dispatching, Gas Measurement and Cathodic Protection sections. Whitaker joined Trans-Canada in 1956, after having been in private business since 1953. Prior to 1953 he had been associated with Lone Star Gas Co., Tennessee Gas Transmission Co., and Transcontinental Gas Pipe Line Corp.

•

William G. Maguire, president of **Panhandle Eastern Pipe Line Company,** and **Charles E. Main,** a director of Panhandle Eastern, have been elected to the board of directors of **National Distillers and Chemical Corporation**. Maguire is also chairman of the board of directors of Panhandle Eastern, and Main is president of **The Clark Estates, Inc.** National Distillers acquired Panhandle Eastern Pipe Line Company's 40 percent minority interest in **National Petro-Chemicals Corporation,** making it a wholly owned subsidiary of National Distillers.

•

Laurel Pipe Line Company announces the addition of four members to its management and supervisory staff. **M. C. Miller** has been elected treasurer; **D. S. Purnell,** a director of Laurel has been appointed manager of operations; **C. F. Sloss** has been named assistant treasurer, and **R. P. Cassiano** has been appointed supervisor of employe relations and office services.

Miller, who has been with Gulf Oil Corporation 34 years, will be in charge of all financial and accounting matters. Purnell will handle all phases of engineering, right-of-way and product movement. Cassiano will direct all personnel matters, purchasing, public relations and office services.

•

Charles H. Mottier, Jr., is the new administrative supervisor in the Supply and Transportation department of **Standard Oil Company (Indiana).** Mottier succeeds **James Zisson.** Mottier has been with Standard Oil since 1948 serving in the Engineering and Heavy Oils Operating departments.

DEATHS

John Carroll Hamilton, 66, president of Arkansas Louisiana Gas Company and subsidiary companies, died December 19 in Kansas City, Mo. He joined Arkansas Louisiana Gas in 1919 and had been an officer since 1946. He was also president of the Arkla Air Conditioning Corporation formed in 1957 and Arkansas Cement Corporation, both owned by Arkansas Louisiana Gas.

Arch Edward Erickson, 72, Tulsa, retired superintendent for Interstate Pipe Line Company, died December 25.

Robert Lewis Breightol, 85, Tulsa, owner of the Maramac Gas Company, Maramac, Kansas, died December 17.

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Fleetweld 5-P Electrodes cut welding costs on pipelines

DESIGNED especially for stringer beads in pipeline welding Fleetweld 5-P gives fast, easy operation. Good arc control contributes to consistent high-quality welds with excellent wash-in and very little slag. Weldors love its smooth arc.

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WHO'S MEETING WHERE

March

Gas Conditioning Conference, sponsored by University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla., March 5-6.

American Society of Mechanical Engineers, Gas Turbine Power Division, Shoreham Hotel, Washington, D. C., March 3-6.

Petroleum & Chemical Industries short course on gas conditioning, University of Oklahoma, Norman, Okla., March 5-6.

Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio, March 7.

NACE Annual Conference, Civic Auditorium, San Francisco, Calif., March 17-21.

New England Gas Association annual meeting, Hotel Statler, Boston, Mass., March 20-21.

American Congress on Surveying and Mapping & American Society of Photogrammetry, consecutive meetings and co-exhibit, Shoreham Hotel, Washington D. C., March 23-29.

Midwest Gas Association, Broadmoor Hotel, Colorado Springs, Colo., March 24-26.

Oklahoma Utilities Association, Annual Convention, Biltmore Hotel, Oklahoma City, Okla., March 27-28.

American Petroleum Institute, Annual Pipe Line Conference, Jung Hotel, New Orleans, La., March 31-April 2.

American Institute of Electrical Engineers, southwest district meeting, Mayo Hotel, Tulsa, Okla., March 31-April 2.

April

Fifth Annual Conference on Corrosion Control, sponsored by University of Oklahoma, Extension Study Center, Norman, Okla., April 1-3.

API, Division of Production, Mid-Continent District Meeting, Biltmore Hotel, Oklahoma City, April 9-11.

Tenth Southwestern I.R.E. Conference & Electronics Show, St. Anthony's Hotel and Municipal Auditorium, San Antonio, Texas, April 10-12.

Pipe Line School of Technology, sponsored by The University of Texas, Baytown, Texas, April 14.

American Welding Society, annual welding show, Kiel Auditorium, St. Louis, April 15-17.

Thirty-fourth Annual Gas Measurement, short course, sponsored by University of Oklahoma, North Campus, Norman, Okla., April 15-17.

Natural Gasoline Association of America, annual convention, Baker & Adolphus Hotels, Dallas, Texas, April 16-18.

American Institute of Mining, Metallurgical, & Petroleum Engineers, Louisiana-Arkansas, East Texas, & Mississippi petroleum sections, gas technology symposium, Shreveport, La., April 17-18.

API, Division of Production, Rocky Mountain District Meeting, Cosmopolitan Hotel, Denver, April 21-23.

Independent Petroleum Association of America, midyear meeting, Hotel Sherman, Chicago, Ill., April 27-29.

Third Annual Conference on Automatic Control in the petroleum & chemical industries, sponsored by University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla., April 28-29.

Southern Gas Association Annual Convention, Dallas, April 28-30.

Automatic control in petroleum and chemical industries, annual conference, University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla., April 28-29.

PIEA & PESA joint convention, Adolphus Hotel, Dallas, Texas, April 29-May 1.

May

LPGA, 27th annual convention, Conrad Hilton Hotel, Chicago, May 4-7.

Institute of Radio Engineers and American Institute of Electrical Engineers, 1958 Western Joint Computer conference, Ambassador Hotel, Los Angeles, May 4-7.

American Gas Association, distribution, production and transmission conference, Roosevelt and Commodore Hotels, New York, May 5-9.

API, Division of Production, Eastern District Meeting, Deshler-Hilton Hotel, Columbus, Ohio, May 7-9.

American Society of Mechanical Engineers, Oil & Gas Power Division 30th annual conference and exhibit, Philadelphia, Pa., May 12-15.

Second Annual Stationary Industrial Engines, course sponsored by University of Oklahoma, at Norman, Okla., May 13-14.

API, Division of Production, Pacific Coast District Meeting, Biltmore Hotel, Los Angeles, May 22-23.

Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa., May 20-22.

June

P.E.P.A. 30th annual meeting, Texas Hotel, Fort Worth, Texas, June 2-4.

A.I.E.E., A.R.S., I.S.A., and L.A.S., 1958 National Telemetering Conference, Lord Baltimore Hotel, Baltimore, Md., June 2-4.

API, division of transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va., June 8-11.

Michigan Gas Association, Grand Hotel, Mackinac Island, Mich., June 21-22.

American Society for Testing Materials, annual meeting and exhibit, Hotel Statler, Boston, Mass., June 22-28.

Pipe Line Division, A.S.C.E. Convention, Multnomah Hotel, Portland, Oregon, June 23-25.

Interstate Oil Compact Commission, mid-year meeting, Hotel Utah, Salt Lake City, Utah, June 23-25.

Canadian Gas Association, annual meeting, Manoir Richelieu Hotel, Murray Bay, Quebec, June 24-27.

PROVEN!

THE ONLY SIDE BOOM ON RUBBER TIRES

SOONER BOOMER

LOW-COST SOONER-BOOMER DOES THE WORK OF 2 CONVENTIONAL MACHINES!

The Sooner-Boomer is the world's first side boom mounted on rubber tires. Designed to handle pipe up to 10", this revolutionary machine eliminates unnecessary right-of-way damage on city work —eliminates the need of pipe stringing along city streets ahead of ditch. A low center of gravity makes the Sooner-Boomer highly stable, loaded or unloaded. It operates at road speeds on back haul, and is equipped with a swamper platform. A 12-foot boom makes it possible to lower in over spoil. Power up and power down on all cables assures ultimate safety and precision line-up. The Sooner-Boomer easily lowers in or bends 8-inch pipe. Excellent performance on clean-up and ditch dressing. The Sooner-Boomer is designed to put all weight on wheels, eliminating any strain on engine, transmission and differential. The versatility of the tractor unit makes it possible for the Sooner-Boomer to do the work of two conventional machines!

OPTIONAL: 7-foot angle dozer; rearend winch; 8 forward and 2 reverse speed transmission; trailer hitch; 3-pin connected, boom mounted bending shoe (available in 2, 4, 6 and 8" sizes).

LIFTING CAPACITY
4 Ft. Radius 3750 lbs. plus
8 Ft. Radius 2450 lbs. plus
10 Ft. Radius 1500 lbs. plus

USING FORD SERIES 600 AND SERIES 800 TRACTORS

Check These Features

- **Mounted On Rubber-Tire Tractor!**
- **Highly Maneuverable at 26 MPH Road Speed!**
- **Power Steering!**
- **No Hauling Problems!**
- **All-Hydraulic Operation!**
- **Hydraulic Controlled Counter Weights!**
- **Perfect Operator Visibility!**
- **12-Foot Boom Handles 10" Pipe!**
- ***Lowest Initial Cost!***
- ***Lowest Operating Cost!***
- **Six months warranty from date of purchase on both the tractor and SOONER BOOMER!**

223 W. BRITTON ROAD, OKLAHOMA CITY

P. O. Box 8832, Phone TRinity 8-4033

Canadian Office: 295 Kipling South, Toronto, Canada

What's Happening among SERVICE and SUPPLY MEN

K. O. Davis

R. L. Durall

Davis and Durall Promoted By Maintenance Engineering

Maintenance Engineering Corporation announces the appointments of Kenneth O. Davis as sales service engineer and Robert L. Durall as sales engineer. Davis will act as sales service engineer in the Chemical division of MECO and Durall will be sales engineer for Hagan controls, distributed by MECO.

Allis-Chalmers Mfg. Company Announces Three Appointments

Allis-Chalmers Manufacturing Company announces three appointments in sales and administrative positions. E. R. Danielson has been promoted as assistant to the vice president and general manager of the General Products division. R. E. Morris is the new manager of the group's St. Louis district, and W. P. Bell has been named manager of the industrial group sales.

Danielson has been associated with the company since 1949 and since 1955 has been office supervisor in the General Products division. Morris had been a sales representative in the Washington office for seven years before being named manager of industrial sales last year. Bell was manager of the national defense sales for the industrial group in Washington last year.

William Blackie Selected Caterpillar Company Director

Caterpillar Tractor Company announces the election of a new director of the company and two appointments in plant engineering. William Blackie is the new director succeeding L. B. Neumiller who recently retired. Walter H. Zurhorst will become plant manager, manufacturing general office, and Harry R. McNeely will succeed Zurhorst as Peoria plant manager.

William Blackie

Blackie joined Caterpillar in 1939 as controller. He became vice president in 1944 and in 1954 was elected executive vice president. He is also a director of the U. S. Chamber of Commerce and chairman of its foreign commerce committee.

Crowley and Weinert Join Pittsburgh Coke & Chemical

Edgar I. Crowley and John R. Weinert have joined the Research and Development departments of Pittsburgh Coke & Chemical Company.

Crowley is associated with the Engineering Development section as a senior chemical engineer, and Weinert is a senior chemist in the laboratory's protective coating section.

Crowley was formerly a process development engineer with Davison Chemical company and Gulf Research and Development Company. Weinert previously served as research chemist with Stoner-Mudge Company, and development chemist with Sterling Varnish Company.

Homelite Opens New Plant In Gastonia, North Carolina

Homelite, a division of Textron Inc., recently opened its new chain saw plant in Gastonia, N. C. The 360-square foot factory is a one-story building with a brief second story on top. The plant features modern equipment and techniques to assure efficiency.

Atlas Powder Company Opens New Post for Western Contractors

Atlas Powder Company announces two new managers in its Explosives Sales departments, Eugene F. Daily is the new Western construction manager, and James M. Ellis succeeds Daily as manager of the San Francisco district. The Western construction manager is a new post established to provide better service to contractors in the West.

Daily joined Atlas in 1936 and has worked with contractors assisting them on their blasting problems.

John M. Meyer Elected Director Of United States Steel Corporation

Appointments in several positions have been announced by United States Steel Corporation. John M. Meyer, Jr., has been named a director of the company succeeding Arthur M. Anderson, retired.

Walter M. Haynes has joined the U. S. Steel staff as district, refinery and pipe line sales manager at the Shreveport, La., office. Lawrence C. Armstrong, Jr., has been appointed area manager, engine and compressor sales for the Oil Well Supply Division at Houston, and T. D. Brissman is the new manager of sales, Houston district office of National Tube Division.

Meyer is a senior vice president and

YOU CAN CONTROL
Scale and Corrosion
Economically and Safely

SAND-BANUM

PURE COLLOIDAL CONCENTRATE
Ounces Only Once a Week Remove
and Prevent Boiler Scale

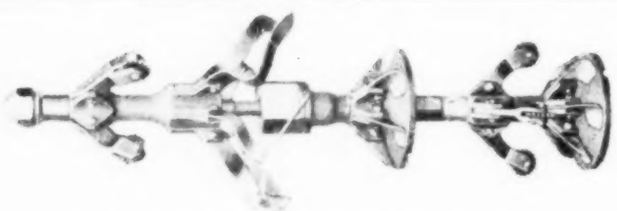
SAND-BANUM SPECIAL

in Handy Tablets—for ALL
Radiator Cooling Systems.
Stocked by Leading Supply Houses

Gulf Coast District Representative
WESTERN SAND-BANUM CO.
1717 Chenevert St., Houston 2, Texas

AMERICAN SAND-BANUM CO.
ESTABLISHED 1926
MEADOW BROOK NATIONAL BANK BUILDING
FREEPORT, NEW YORK
SAND BANUM

Go-Devil



Standard Model Northrup Go-Devil with leather disc drivers

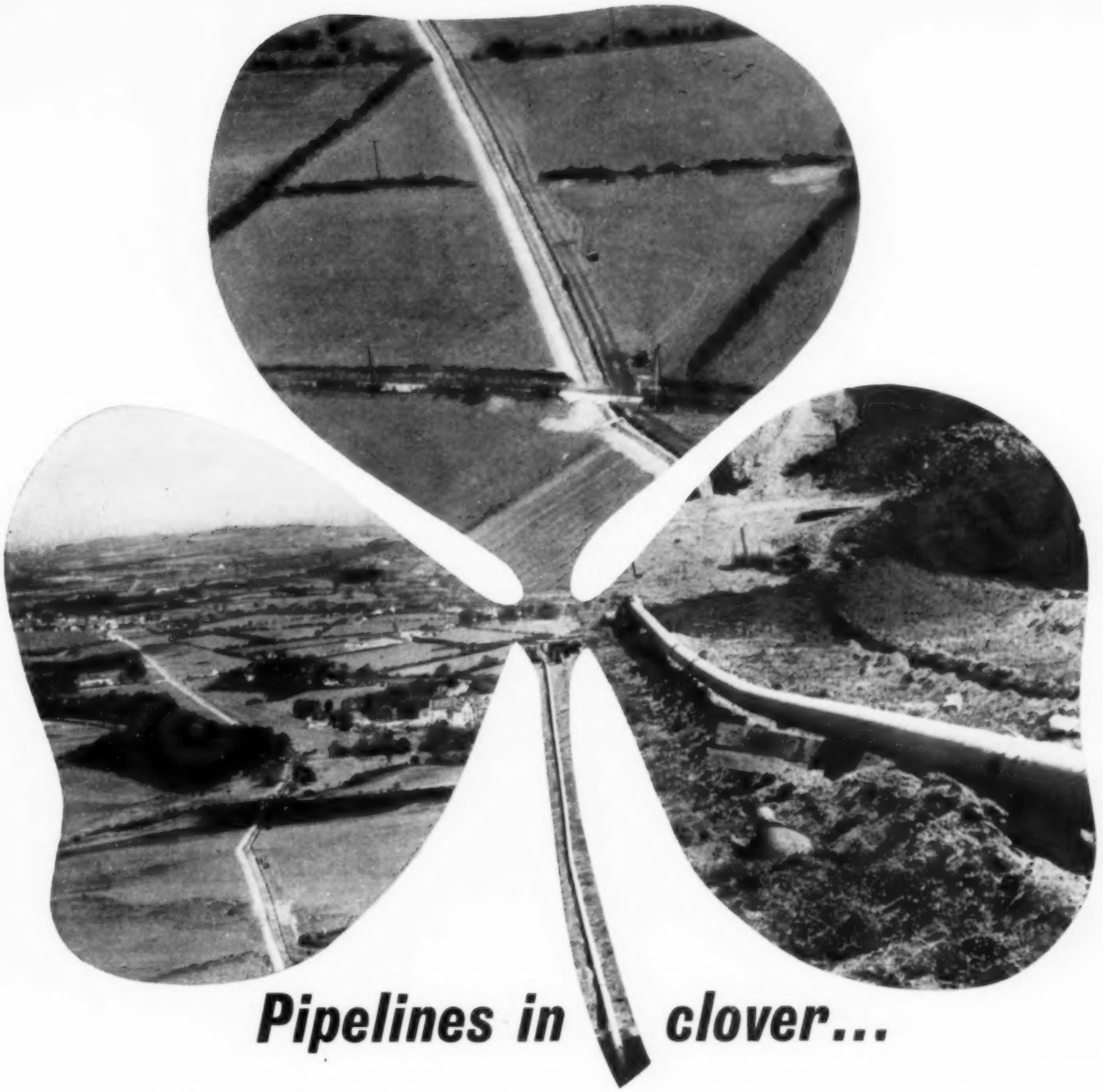
G. A. COTTEN CO.

Manufacturer of

NORTHRUP GO-DEVILS & TRANSIT PIPE LINE SCRAPERS

P. O. Box 5332 — Tulsa, Okla.

For more data on advertised products, use Readers' Service Cards, last page.



Pipelines in clover...

A pipeline wrapped in Fibreglass has nothing to worry about — because asphaltic or coal-tar enamel strengthened with Fibreglass pipewrap has *maximum* resistance to corrosion, soil stress and backfill damage.

Fibreglass reinforced tissue is specifically designed for high-speed machine application to oil and other pipelines. It offers unequalled porosity characteristics which give an even and immediate bleed-through of enamel. Fibreglass reinforced tissue does not lie on the surface of the enamel, but is positioned in the body of the finished coating. The special binders developed by Fibreglass in parallel-reinforced pipewrap tissue not only help to provide extremely high tear and tensile strength, but will withstand immersion under load in hot enamel at over 500 degrees Fahrenheit.

...are wrapped in FIBREGLASS TRADE MARK

FIBREGLASS LTD., ST. HELENS, LANCASHIRE • ST. HELENS 4224

For more data on advertised products, use Readers' Service Cards, last page.

TD-24 Sideboom p
spots twisted pipe with i

precision control
inch-close accuracy!

Have a close look at the gulch-crossing, grade-climbing course this new Pacific Gas and Electric Company line takes in Jackass Pass near Mendota, California—on a section being laid by Midwestern Constructors, Inc., Tulsa, Oklahoma. Then you'll appreciate the special TD-24 spread-speeding, pipe-handling precision that earns high praise from the boss:

Earl R. Wolfe, pipe-lowering and tie-in foreman on the spread, reports: "With the International Superior TD-24 side-boom tractors I've been able to fit twisted pipe into the ditch many times without cutting. And that means in places where with other tractors, the pipe would have had to be cut. My welders have it easy. I don't known of any other side-boom equipment that could handle the 34-inch pipe on this mountain operation so well."

Control Begins with Planet Power steering!

This twisted-pipe-spotting, precision handling control begins with exclusive International TD-24 Planet Power steering. You can feed full-time live power to both tracks smoothly and steadily—to turn as sharply or gradually as desired—without eccentric, jerky travel even with heavily-loaded boom!

Exclusive TD-24 finger-tip hydraulic braking and foot decelerator help give positive pipe-carrying control by exact regulation of tractor motion. And with minimum operator effort, from reach-easy control lever clusters, the International Superior TD-24 gives you amazing *response* speed, and *inch-close* accuracy of boom action control!

Get on-the-line proof of the big, exclusive International Superior TD-24 precision, spread-speeding advantages. Compare new bonus-powered TD-18, TD-14, and TD-9 side-booms to any other units in their size classes. See your International Construction Equipment Distributor for a demonstration of the boom and tow equipment you need!

Grades on this mountainous section of new 34-inch P.G. & E. gas line ranged from 37% to 57%. Yet time and again, the boom team saved vital, weather-beating hours—using outstanding International Superior TD-24 side-boom precision control to lay twisted pipe without cutting! Picture shows Midwestern's TD-24 side-booms working as a team!

INTERNATIONAL®
SUPERIOR®

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Side-Boom Tractors ... Self-Propelled Scrapers and Bottom-Dumps ... Crawler and Rubber-Tired Loaders ... Off-Highway Trucks ... Diesel and Carbureted Engines ... Motor Trucks

The W-S double diamond brand mark symbolizes more than a century of pioneering manufacture in the fields of pipe fittings and hydraulic jacks and pumps.

For almost a century the Cleveland brand has marked industry's best automotive and industrial hardware and commercial forgings and die casting.

Now, the two manufacturing organizations which bear these brands have combined to continue and enlarge their line of quality products and to increase service to you through exchange of technical experience and through distribution facilities from coast to coast. Now, from one source, you may obtain the finest in forged carbon, stainless and alloy steel pipe fittings, unions and couplets; hydraulic jacks and pumps; stock forgings for trucks, buses and other vehicles; commercial forgings and die castings for all industry.

This means additional service from the growing facilities of H. K. Porter Company, Inc., where planned diversification has resulted in a product for every industrial plant.

H. K. PORTER COMPANY, INC.

FORGE AND FITTINGS DIVISION

W-S Fittings Works, Roselle, N.J. • Cleveland Forge Works, Cleveland 4, Ohio
Stainless Steel Works, Duncannon, Pa. • Cleveland Die Cast Works, Cleveland 4, Ohio

director of J. P. Morgan & Co. Incorporated and has been with the company since 1933. Brissman has been associated with U. S. Steel since 1939 and prior to his promotion was special representative of oil and gas industry.

O. W. Wade

Pearce Butterfield

Wade, Butterfield Form The World Supply Company

O. W. Wade and Pearce Butterfield, former corrosion engineers with Transcontinental Pipe Line Corporation, have formed the World Supply Co. with headquarters in Houston.

Wade is the president of the company, and Butterfield is chief engineer. Products to be handled by the World Supply Co. include Gulf States Pipeline Coating, Texas Glass Fibers, F. H. Maloney Products, specialized protective coating materials and pipe line specialty products.

Falcon Line Products Corp. Announces Manager Appointment

J. M. (Jack) Fouts has joined Falcon Line Products Corporation as Northeastern division manager.

J. M. Fouts

Prior to his appointment with Falcon, Fouts had been with the Sales department of Koppers Company, Tar Products division. Fouts, a veteran of 25 years in the corrosion engineering, will specialize in the sale of cathodic protection and corrosion control materials, equipment, and supplies.

Fouts was associated with New York Telephone Company for 20 years, and from 1946-1957 he was corrosion engineer, Western New York area.

BorTunCo Completes Transfer to New Quarters

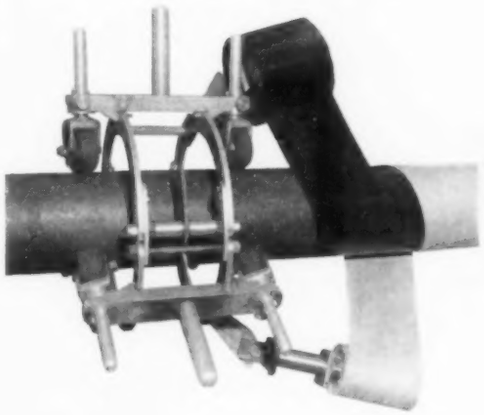
BorTunCo, road boring and tunneling company, has completed moving operations and arrangements in relocating its Houston headquarters. The BorTunCo companies operating from Houston include Horizontal Holes, Inc.; Texas Tunneling Company; Boring and Tunneling Company of America; Texas Road Boring Company of La.-Miss.; and Road Boring and Tunneling Company, Inc.

Everett Sarratt Appointed Chief Engineer by Tracerlab

Tracerlab, Inc., announces the appointment of Everett Sarratt as chief engineer,

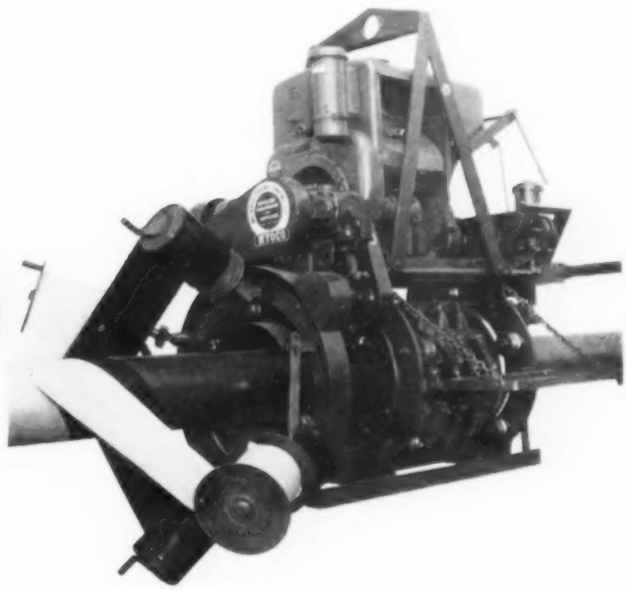
MYOCO... For More Dependable Equipment and Service

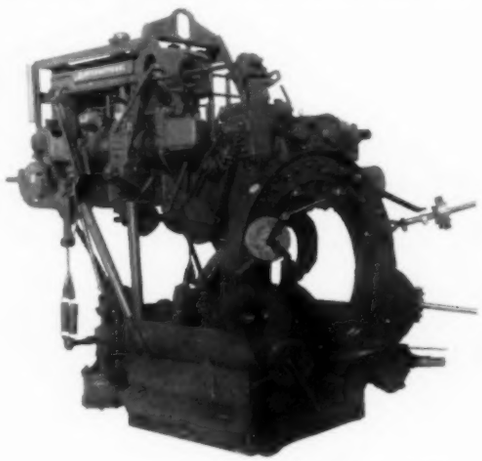
HERE ARE MACHINES THAT BRING ADDED EFFICIENCY TO YOUR TAPING, CLEANING AND TAPING, AND COATING AND WRAPPING



The MYOCO Tapemaster can use four arms to give any combination of tape and kraft or felt. Six various size machines available for ½" thru 36" pipe; small machines use tape from ½" width thru 9", large machines use 9" thru 18" tape.

MYOCO Model OW Power Driven Cleaning and Taping machine combines two operations for increased speed of operations with less equipment. Line travel machines are available to handle pipe sizes 3" to 6", 6" to 12", and 14" to 20". A Wisconsin Model Vg4D V-type 4-cylinder heavy-duty air cooled engine, combined with the design and engineering features of this machine, guarantees uninterrupted service.





The MYOCO Coating and Wrapping Machine is powered by an International Gasoline Engine, with electric starter, spray type shoes, and heavy-duty transmissions and clutches. This new machine features under-pressure-crawler wheels equipped with hydraulic cylinder to maintain positive contact, easily controlled by the operator.

When you use MYOCO pipeline equipment, you quickly find that servicemen are experienced and available twenty-four hours a day, with fast transportation available to serve you in any way; efficient equipment operation is assured by periodical checks; and if possible, parts and supplies are shipped the same day ordered.

MORRIS-YOUNG-OWENS CO. PIPELINE EQUIPMENT AND SUPPLIES HOUSTON, TEXAS MYOCO

MORRIS-YOUNG-OWENS CO.

PIPELINE EQUIPMENT AND SUPPLIES

14000 South Main Street • Telephone MAdison 3-4425 • Houston, Texas

In Canada: MYOCO LIMITED, 30 Bloor Street West

Toronto 5, Ontario, Canada • Tel. WA 2-9444

instrument products. Sarratt will be responsible for engineering and development of new Tracerlab products covering the complete field of nuclear laboratory equipment. Prior to joining Tracerlab, Sarratt was chief engineer of the Marine division of McKay Radio.

Three Appointments Announced By Ralph N. Brodie Company

R. L. Phillips assumes the newly created post of administrative assistant to the sales manager for Ralph N. Brodie Company. William M. Brown succeeds Phillips as purchasing agent for the San Leandor, Calif., manufacturer of Brodie BiRotor equipment.

Ken K. LaPoint has been appointed to coordinate engineering and sales activities relating to Brodie Model 500 automatic control valves.

G. Frank Reed

Walter E. Sutter

General Electric Announces Communications Appointments

General Electric announces two appointments in its Communications Products department. Walter E. Sutter has been named national manager of microwave sales, and G. Frank Reed is the new regional manager for mobile radio and communication equipment to be sold in the oil, pipe line and drilling fields in Texas, Oklahoma and New Mexico.

Sutter in advancing from district microwave sales manager at Redwood City, Calif., will be responsible for equipment sold to pipe line firms and other types of users. Sutter joined General Electric in 1946 and has since worked in the communications organization.

Reed has been associated with the company since 1947 and prior to his promotion was regional manager for Communications department at Columbus.

Southern Pipe Coating Co. Names Aycock Superintendent

A. B. Aycock is the new plant superintendent for Southern Pipe Coating Company. He will be in charge of all pipe coating and wraping work done at the company's 17-acre facilities in Doraville, an Atlanta suburb. Aycock formerly had been superintendent of production at Mayes Brothers, Inc., and prior to that he did maintenance and construction work for United Gas Pipe Line Company.

A. B. Aycock

Lutz Appointed to New Post By Wilkening Manufacturing Co.

John O. Lutz has been promoted to the newly created position of general sales manager of the Wilkening Manufacturing Company. Lutz will supervise the sales activities of the Automotive Replacement division, Industrial division, Manufacturers division and Export division.

Lutz has had extensive experience in production, design and development of internal combustion engines with Baldwin-Lima-Hamilton Corp. and North Carolina Shipbuilding Co.

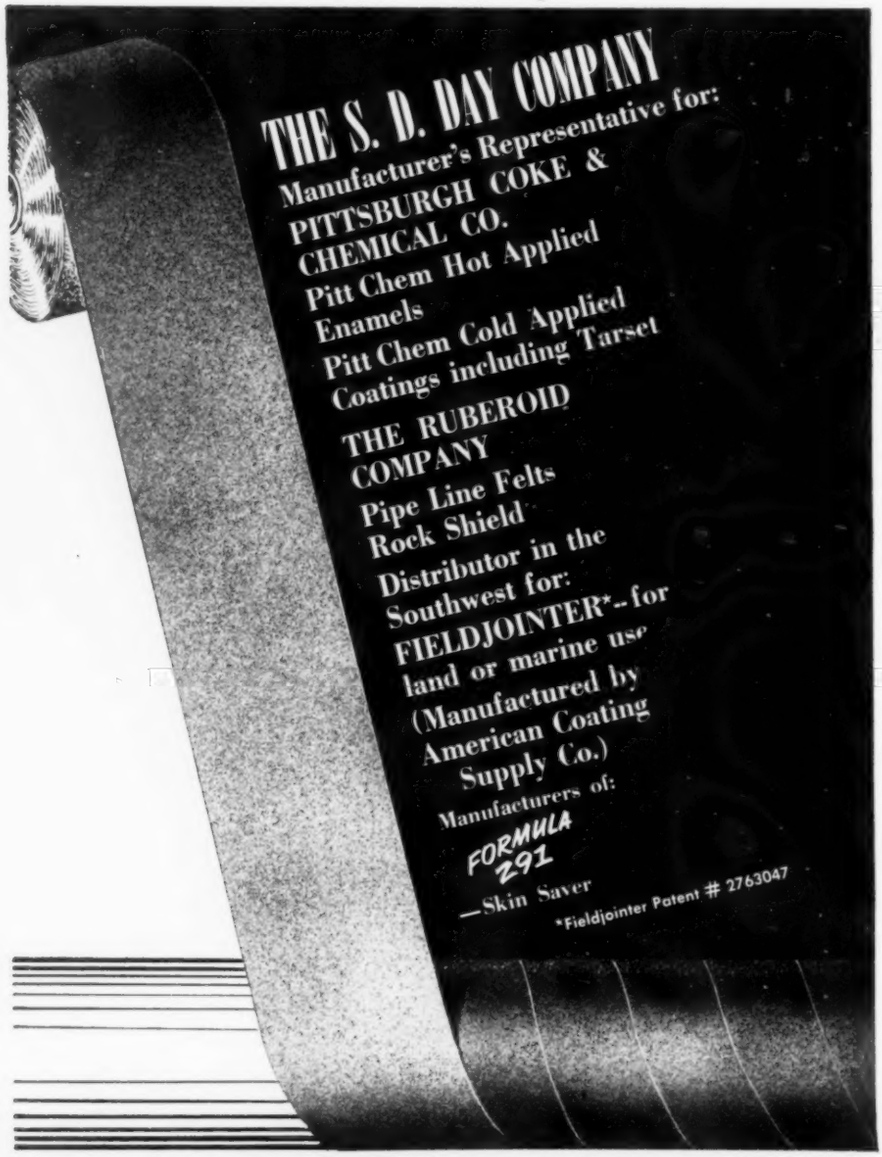
Plant Expansion Construction Begun By Kaiser Steel Corporation

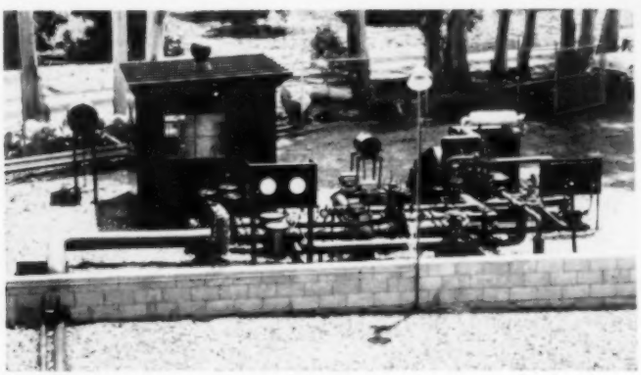
Construction has begun on Kaiser Steel Fabricating Division's $2 million plant in Napa, Calif. The expansion program will be completed in 1959 and will nearly double the Napa plant's pipe making capacity.

Major facilities under construction include a 50,000 square foot addition to the pipe fabrication plant to house additional welding, facing, expanding and testing facilities, new buildings and more handling and storage areas.

Gardner-Denver Appoints Two Sales Representatives

Gardner-Denver Company announces two assignments for personnel in the Sales department. Walter Vail, formerly oil field special representative in Quincy, has been transferred to Tulsa as special representative to work with Jones & Laughlin. Eugene R. Monroe has been named oil field special representative in the home office. He will specialize in water-flood and oil well servicing operations of the company.





Hot water jacketing on Brodie Meters and throughout system maintains 150 F temperature in the blend of two crudes, one averaging 12° grav. and 20,000 S. S. U. visc., the other 15° and 3,800 S. S. U. at 100 F.

This compact Union Oil Company installation, with two Brodie *BiRotor* Meters, replaces conventional high tankage requirements for custody transfer.

L.A.C.T. proves practical handling heavy crudes with BRODIE *BiRotor* METERS

2,200 bbl. daily of low gravity, highly viscous crudes are transferred to Union Oil Company through their Yorba Linda, California, Automatic Custody Transfer System. Flow is accurately measured and recorded by two Brodie *BiRotor* Positive Displacement Meters with dual Brodimatic Printing Counters. Proving is on gravimetric basis.

In more and more producing areas, automatic custody transfer with the sustained accuracy of Brodie *BiRotor* Meters is gaining favor for elimination of human error in stick measurement methods, evaporation losses, clinging of crudes to tank walls, danger and inconvenience of climbing tank ladders in all kinds of weather, and the high cost of unnecessary tankage. Contact your Brodie Metering Specialist for the full story of *BiRotor* Meter advantages in L. A. C. T. service.

711

ALL-STEEL BiRotor TRUE-ROTARY

BRODIE METERS

RALPH N. BRODIE COMPANY • San Leandro, California, U.S.A.

MT. VERNON, N. Y.	DALLAS 7, TEXAS	CHICAGO OFFICE:	SEATTLE 9, WASH.	LOS ANGELES 22, CALIF.
550 So. Columbus Ave.	167 Parkhouse St.	1227 Circle Ave., Forest Park, Ill.	221 9th Ave. N.	5401 Sheila Street

REPRESENTATIVES WITH STOCKS AND SERVICE FACILITIES IN ALL PRINCIPAL CITIES

Bright highlight along lower face of ring shows pre-seated area from factory lapping.

You have no long break-in period with PEDRICK Chrome Rings. Almost immediately you get the full benefits of the Chrome surface which is practically scuffless, which withstands high temperatures, abrasion and corrosion, and which increases ring life up to four times.

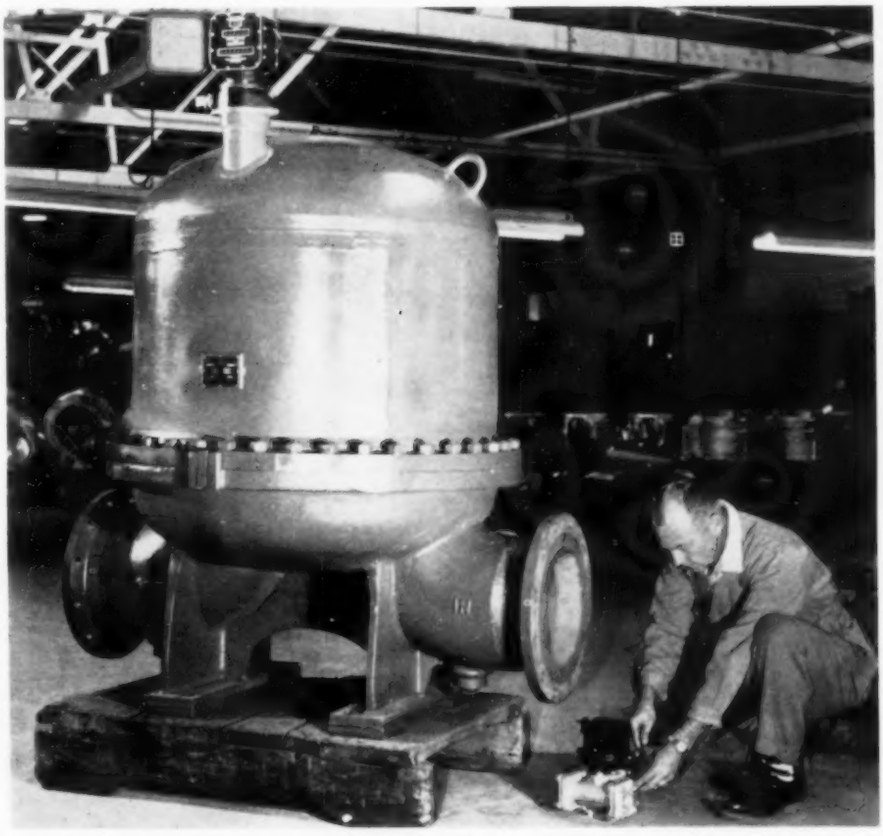
This is so because PEDRICK laps or pre-seats its Chrome rings to cylinder size at the factory. This reduces break-in time up to 80% and enables the engine to be put under full load very quickly, with all the benefits of Chrome. Furthermore, PEDRICK Chrome rings are the most-modern twist-seal or taper-face designs, which in themselves speed seating and assure a quick, positive seal.

So, for the very best in quality, the very latest in engineering design, make your rings PEDRICK. Let our engineers cooperate with you on special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Penna., SAratoga 9-3770.

Pedrick PISTON RINGS

PEDRICK PIONEERED *Conformable* PISTON RINGS FOR BIG-BORE ENGINES

What's New in EQUIPMENT



BiRotor Meter

The Ralph N. Brodie Company announces its positive displacement meter which has a capacity of 5,000 barrels per hour at a working pressure of 300 psi. The meter is designed to handle petroleum products or crudes in pipe lines, bunkering, barge and tank loading and other high capacity services.

Features of the Brodie Model B-123 include double case construction isolating the measuring unit from piping strain, ball bearing rotor mounting, rotary operation without vanes or reciprocating parts and absence of metal-to-metal contact with just two moving parts in the measuring chamber.

Removal of cover dome provides accessibility to the measuring unit for inspection or cleaning without disturbing line connections.

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

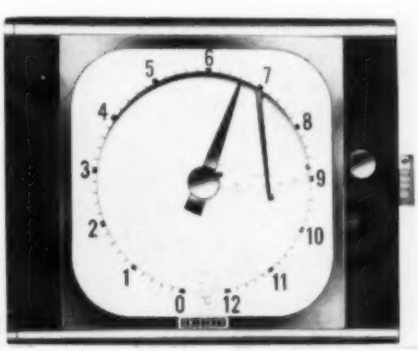
Normalizing Kit

Reduction of engine horsepower caused by operation at high altitude can be eliminated on Caterpillar's D6 tractor by use of Caterpillar Tractor Company's new normalizing kit.

The new kit consists of a turbocharger and all manifolds needed to mount it on the tractor engine. This overcomes the cause of high altitude loss—insufficient oxygen to permit complete combustion of fuel. The turbocharger delivers air to the inlet manifold at greater than atmospheric pressure, thus allowing complete fuel combustion and restoring "sea level" horsepower.

(This item supplements Caterpillar Tractor data on Pages 67-69 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E2** on Readers' Service Card, last page this issue.



Combination Recorder

Instruments, Inc., has announced a combination BS&W recorder and temperature recorder. The combining of both recording mechanisms simplifies many pipe line installations where separate BS&W and temperature recorders would be used.

The BS&W is recorded on one pen and temperature on the other, to provide simultaneous indications of both variables.

The temperature measuring system incorporated in the unit is a "filled system," with the bulb designed for location directly in the pipe line. A connection from the sensing bulb to the recorder is made, using flexible stainless steel capillary tubing.

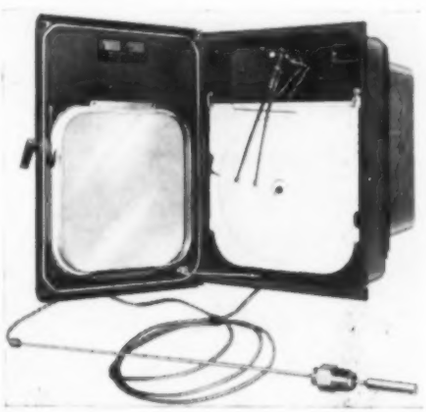
For more data, circle **No. E3** on Readers' Service Card, last page this issue.

Lapping Machine

Crane Packing Co. announces a new lapping machine designed for maintenance lapping. The Lapmaster Model 10 will reface mechanical seals, valve seats, compressor discs, fuel injector parts and a variety of other parts to a precision flatness of .0000116 and with micro-finishes of 2 or 3 rms.

The Model 10 has the basic design and engineering features that have proved successful in larger lapmasters. The lapmaster does not have to be stopped for redressing or truing the lap plate. Flatness of the lap plate is continuously maintained by the patented action of the conditioning rings.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.



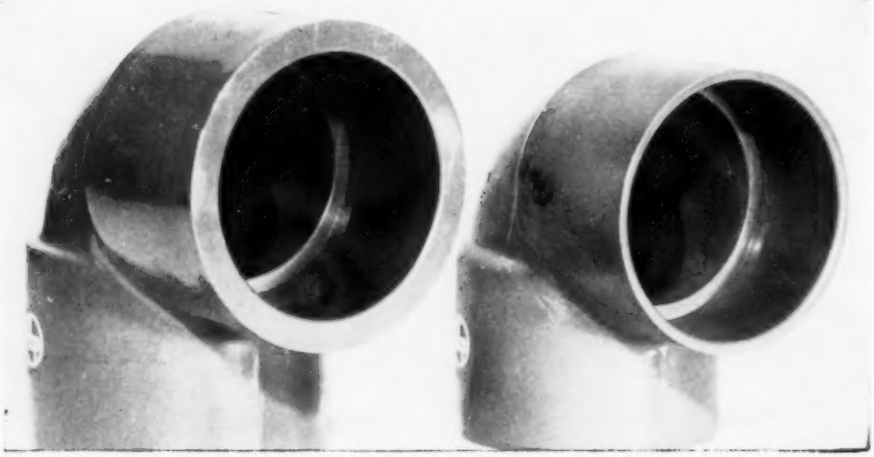
Indicating Dynamaster

The Bristol Company announces a new indicating version of the Dynamaster self-balancing electronic potentiometer or bridge. The indicator is designed to give legible readings from greater distances.

The instrument is also offered in electric control models, in on-off, two-position, three-position, floating, proportional and current-input types of control.

It can be used for measurements of such variables as temperatures, speed, pressure, smoke density, pH and electrical valves.

For more data, circle **No. E5** on Readers' Service Card, last page this issue.



Pipe Fittings

Tube Turns Plastics, Inc. has announced a light weight injection-molded pipe fittings of unplasticized polyvinyl chloride (PVC). The lighter, economical fittings will contribute to increased use of light weight piping systems under moderate pressure and temperature conditions.

The new fittings, which match the burst strength of schedule 40 PVC pipe, will cost about one-third less than Tube Turns Plastics regular line of standard heavy wall fittings.

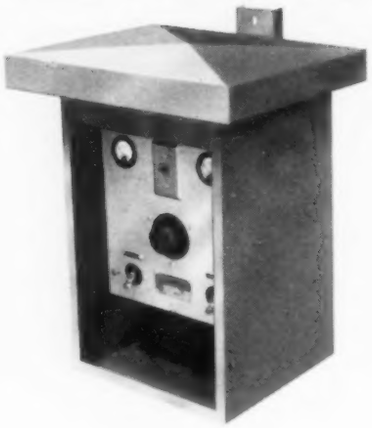
This new line includes 90 and 45-degree elbows, tees, couplings and caps in ¾ to 2-inch sizes, as well as 3 and 4-inch couplings. Pictured is the light weight 90-degree elbow (right) as compared with standard heavy wall elbow.

For more data, circle **No. E6** on Readers' Service Card, last page this issue.

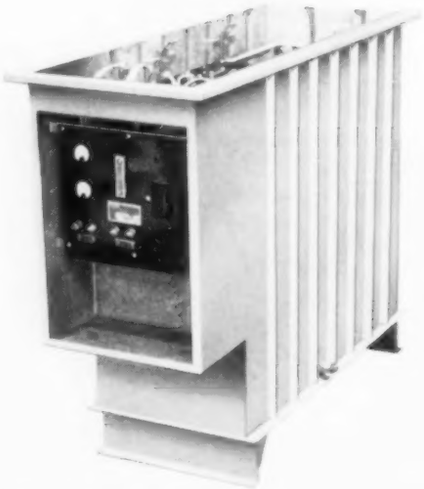
CORROSION?

Look HERE for Complete Cathodic Engineering and Supply

Cathodic Engineering & Supply is your complete source for:



- **Engineering and survey**
- **Rectifiers—custom and standard**
- **Anodes—graphite and magnesium**
- **Heater treater anodes**
- **Cable and accessories**
- **Test instruments**
- **Electronic controls**



Don't close your books on a cathodic protection deal until you have prices from Cathodic Engineering & Supply.

CATHODIC ENGINEERING & SUPPLY, INC.

4200 Perry Street **Houston, Texas**

Leak Detector

Fisher Research Laboratory, Inc., has developed a new transistorized M-scope combination pipe finder-leak detector. Transistors, printed circuits, fiberglass cases and single turn solid aluminum detecting loops are some of the materials of the M-scope.

The pipe finder-leak detector gives a more accurate, durable and economical detector with greater depth penetration. Transistors provide exceptional battery economy with the battery life estimated at 1,500 hours of continuous operation.

Other features include simplified operation procedure, built-in battery testers, power selection control, detachable carrying belt and complete illustrated instructions.

For more data circle **No. E7** on Readers' Service Card, last page this issue.

Audio Oscillator

An audio oscillator for testing pipe coating discontinuity on pipe lines and for locating buried pipe has been developed by Tinker & Rasor. The oscillator develops 15 watts at 750 cycles per second into a 500 ohm load. It operates from a 12 volt battery and has a conversion effi-

BITUMASTIC
HOT & COLD APPLIED COATINGS

TAPECOAT
PIPE JOINT PROTECTION

MAVOR • KELLY
COMPANY

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above ground
CORROSION PREVENTION
below ground

PERMAGILE

So SIMPLE We Can Adapt It to ANY LIQUID LEVEL CONTROL JOB

A sleeve, raised and lowered within a non-magnetic tube, attracts or releases an Alnico magnet attached to a mercury switch. Basically, this is Magnetrol.

MAGNETROL

AS DEPENDABLE AS MAGNETIC FORCE ITSELF

● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

Because of the utter simplicity and dependability of its magnetic principle, Magnetrol has *infinite operating life.* There are no wearing parts to get out of order.

Magnetrols are available for controlling level changes from .0025-in. to 150-ft., with single or multi-stage switching. Our experienced engineering staff is at your service.

MAGNETROL, Inc.

WHY NOT MAIL THE COUPON — NOW

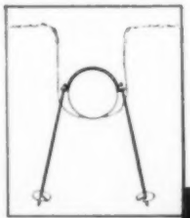
Magnetrol, Inc., 2128 S. Marshall Blvd., Chicago 23, Illinois 7
Please send me catalog data and full information on Magnetrol Liquid Level Controls.
Name _____
Company _____
Address _____
City _____ Zone _____ State _____

Here's the Fast Easy Way to Anchor Pipelines

No heavy equipment to haul. Cuts costs to a fraction.

Chance Pipe Line Screw Anchors and Brackets greatly simplify pipe line anchoring, compared to other methods, and save many dollars in pipe line construction.

Chance Pipe Line Screw Anchors can be installed in pipe line ditches without extra digging. Using a power wrench the operator merely guides the anchor in place. The tool does the work

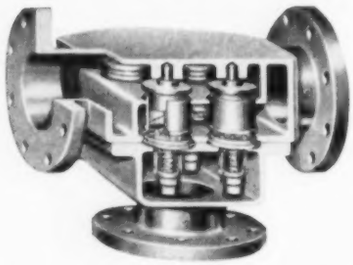


Can be installed in the ditch without extra digging.

Write for catalog showing oil industry applications of Chance Earth Anchors.

A·B·CHANCE CO·
CENTRALIA, MISSOURI
TORONTO, ONTARIO, CANADA

AMOT Engine Controls



AMOT is the best known name in controls for pipe line engines, and many pipe line companies have up-dated their installed equipment with the **AMOT CONTROLS** listed below.

- **THERMOSTATIC VALVES**
  For jacket water and lube oil temperature control.
- **MECHANICAL SAFETY CONTROLS**
  Shut down engine on high water temp. or low oil pressure.
- **SAFETY CONTROL SWITCHES**
  Sound alarms on high water temperature or low oil pressure.
- **VENTED DIAPHRAGM GAS VALVES**
  Shut off main gas supply to gas engines.
- **THERMOSTATICALLY ACTUATED AIR VALVES**
  For automatic fuel change over.

AMOT MAINTAINS REPRESENTATIVES IN PRINCIPAL CITIES
CATALOG AVAILABLE ON REQUEST

AMOT CONTROLS CORP.

FIRST ST. & NEVIN AVE. RICHMOND, CALIFORNIA

APPROVED BY REFINERS

CONTAINS NO CHLORINATED SOLVENTS

OR OTHER HALIDES OR SULPHIDES

BrakeSol

The most effective chemical for treating

PARAFFIN

Control paraffin in tubing, flow lines and tanks by the CONSTANT injection of BRAKESOL. This eliminates costly Paraffin removal methods. Reclaim tank bottoms with BRAKESOL.

FOR SERVICE
Contact your Supply Store or nearby Treating Engineer.

BrakeSol INC.

P. O. BOX 9506 • OKLAHOMA CITY, OKLA.
EXPORT DISTRIBUTOR: THE NATIONAL SUPPLY CO., EXPORT DIVISION

VALLEY

LIGHTWEIGHT

STEEL PIPE

Manufactured in new, modern continuous mills to specifications per ASTM - A 139 Grade B; which also conforms to API 5L standards. Automatic electric butt welded process, using CO^2 gas. Pressure tested. Ideal for use as line pipe for gas and oil, for municipal water systems and irrigation, high velocity tubing for air conditioning and heating, heat exchangers, well casing, grain and mineral spouting, mining, signs, as well as many other manufacturing and industrial uses.

Available in 6", 6⅝", 8", 8⅝", 10", 10¾", 12", 12¾", 14", 16" diameters; from 14 gauge up to and including .219 wall thickness; 20, 30 or 40 foot lengths; in plain or belled ends. Quotations available for Victaulic or Dresser end processing, and coating and wrapping.

Available for immediate delivery.

Write or call for full specification and production data to: **Steel Pipe Division**

VALLEY Manufacturing Company Valley, Nebraska

Serving the Pipeline Industry

with Lincoln Arc Welding Supplies

BIG THREE

WELDING SUPPLY CO.
is happy to announce their appointment as

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PORTABLE ROTARY AIR COMPRESSORS
(Designed for the pipeline industry)

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CONTRACTORS TOOLS AND PUMPS
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EL PASO
LONGVIEW
ALBUQUERQUE
FARMINGTON

ciency of better than 70 percent, enabling a large amount of audio power to be applied to pipe lines with a minimum of battery drain.

(This item supplements Tinker & Rasor data on Page 397 of the Pipe Line Composite Catalog, 1st Edition.)

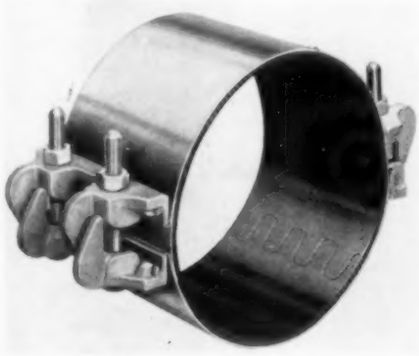
For more data, circle **No. E8** on Readers' Service Card, last page this issue.

Lighting Sets

Joy Manufacturing Company announces a line of new low voltage lighting sets in choices of 6, 12 or 32 volts, from conventional 110/120 V.A.C. power sources.

Sets consist of a circuit breaker, protected "step down" transformer housed in a moisture-tight cast aluminum case with one through four handlamp extensions that plug into receptacles on each end of the carrying case. A 6-foot power extension with male end plug that connects to conventional (three contact) grounded female receptacles is supplied. Third wire in extensions connects ground to transformer case and to metal lamp guards.

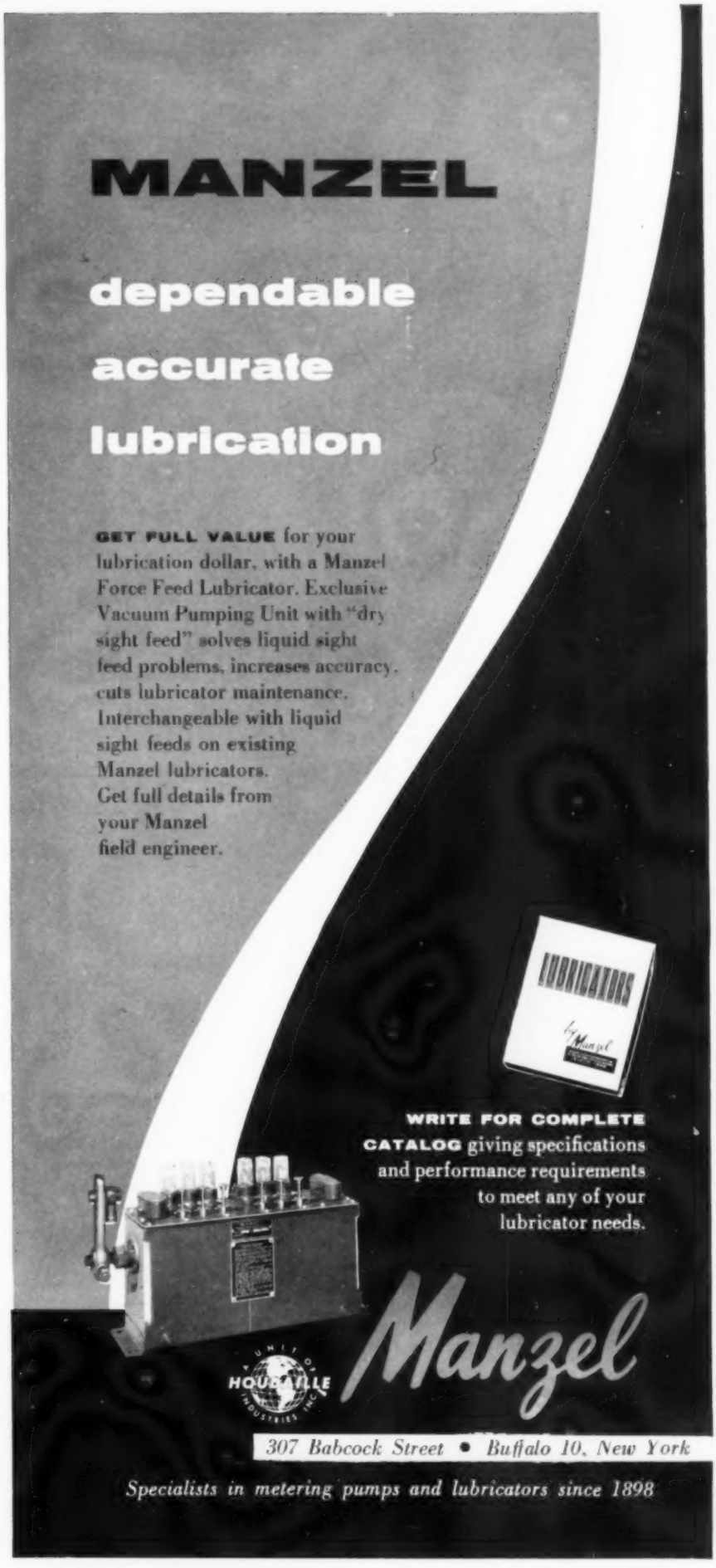
For more data, circle **No. E9** on Readers' Service Card, last page this issue.



Repair Clamp

Dresser Manufacturing Division announces a new all-around repair clamp, the Dresser 360. The clamp, made of stainless steel and Grade A malleable iron, provides an easier-to-install, more efficient method of repairing full breaks or holes in asbestos-cement and cast iron water lines in oil fields, water and sewage systems, plants and factories.

For more data, circle **No. E10** on Readers' Service Card, last page this issue.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lubrication
GET FULL VALUE for your lubrication dollar, with a Manzel Force Feed Lubricator. Exclusive Vacuum Pumping Unit with "dry sight feed" solves liquid sight feed problems, increases accuracy, cuts lubricator maintenance. Interchangeable with liquid sight feeds on existing Manzel lubricators. Get full details from your Manzel field engineer.
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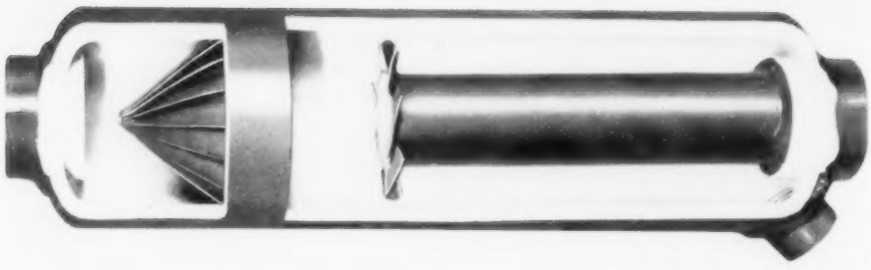
WRITE FOR COMPLETE CATALOG giving specifications and performance requirements to meet any of your lubricator needs.
A UNIT OF HOUDAILLE INDUSTRIES INC.
Manzel
307 Babcock Street • Buffalo 10, New York
Specialists in metering pumps and lubricators since 1898



Line Purifier

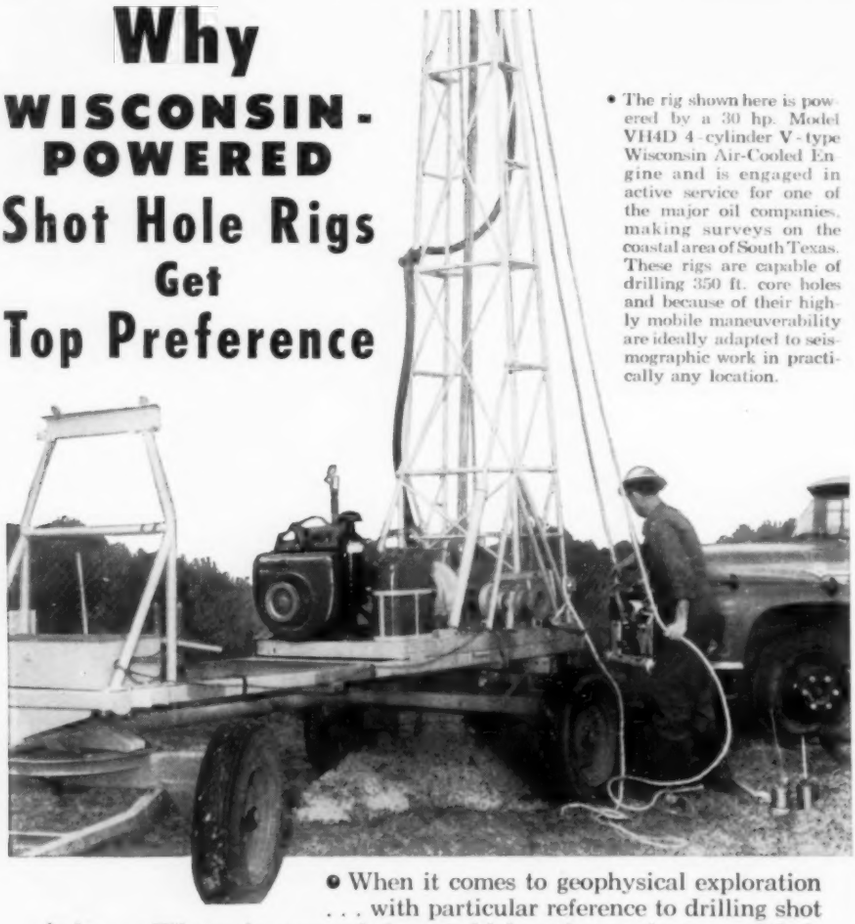
Centrifix Corporation announces a new line purifier with an increased separating efficiency and wider range of flow. The purifier provides more complete removal of water, oil, pipe scale, rust and sediment from compressed air, steam or vapor lines.

In gas transmission lines these Centrifix purifiers remove oil, gasoline and moisture, resulting in added protection for compressors and valves. They can also be used for steam separators for small engines and turbines.

The centrifix Type RA line purifier uses centrifugal force to effect a positive separation and is guaranteed to remove 99% of all entrainment when properly installed.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.

Why WISCONSIN-POWERED Shot Hole Rigs Get Top Preference



• The rig shown here is powered by a 30 hp. Model VH4D 4-cylinder V-type Wisconsin Air-Cooled Engine and is engaged in active service for one of the major oil companies, making surveys on the coastal area of South Texas. These rigs are capable of drilling 350 ft. core holes and because of their highly mobile maneuverability are ideally adapted to seismographic work in practically any location.

• When it comes to geophysical exploration . . . with particular reference to drilling shot holes . . . Wisconsin-powered rigs rate high preference because of their heavy-duty dependability, relatively light weight, simplicity of operation and servicing. High Torque Performance characteristics and all-weather AIR-COOLING.

The Wisconsin Engine will keep slugging away in any climate, in any weather, at temperatures ranging from low sub-zero to 140° F. Trouble-free AIR-COOLING makes the difference! And when it comes to serviceability, Stellite exhaust valves and valve-seat inserts, in combination with positive-type valve rotators, increase valve life up to 500% . . . with a comparable reduction in servicing.

If you have a power job within a 3 to 56 hp. range, let a Wisconsin Heavy-Duty Air-Cooled Engine handle it. Write for Engine Bulletin S-223.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
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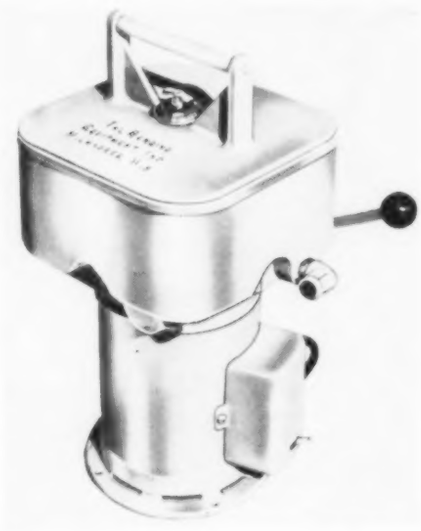
3420 McKINNEY AVENUE • HOUSTON, TEXAS
505 SOUTH MAIN STREET • WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

A8-6177



Motor Pump

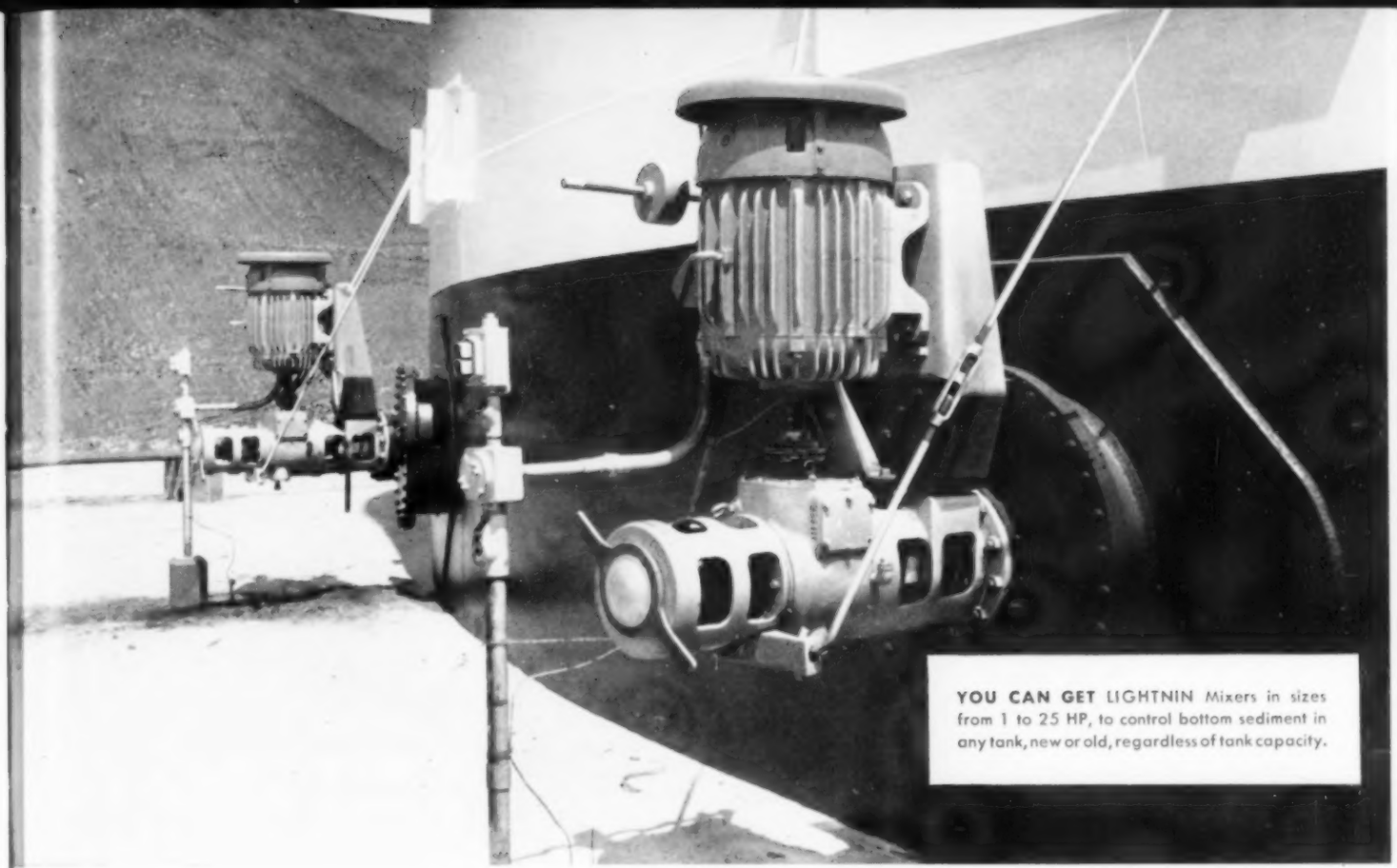
Tal Bending Equipment, Inc. announces the development of a fast, portable hydraulic motor pump developing up to 10,000 pounds per square inch pressure and weighing only 65 pounds.

The motor pump can be used with hydraulic pipe benders, pipe pushers, knockout punches, hydraulic jacks of any kind, and it can be installed to give fast continuous power to existing equipment. The pump is rated for 10,000 psi intermittent and 5,000 psi continued duty delivering 80 cubic inches of oil per minute.

For more data, circle **No. E12** on Readers' Service Card, last page this issue.

Plastic Insulator

F. H. Maloney Company has developed a plastic insulator said to be impervious to moisture, corrosion and decay. The in-



YOU CAN GET LIGHTNIN Mixers in sizes from 1 to 25 HP, to control bottom sediment in any tank, new or old, regardless of tank capacity.

How to store 10% more crude *without putting up another tank*

Every time you give up an *inch* of tank storage space to settled sludge, you lose many barrels of holding capacity.

Even under normal conditions, your dead storage from accumulated BS&W can run as high as 10% of your total storage capacity.

Get full capacity

You can keep your tanks ready for maximum storage—ready to work at full capacity all the time—with LIGHTNIN Mixers.

An efficient propeller stream turns over the entire tank contents, holds heavy sludge components off the tank bottom, and keeps the crude uniform. You dispatch the *same petroleum values that you receive.*

Cut tank cleaning cost, too

You cut operating costs when you install LIGHTNINS. Careful field tests prove it. Say good-bye to costly, messy sludge cleanout jobs that keep your tanks out of service just when you need them. Instead, you keep your tanks clean by flipping a switch!

How to get started

More than 50 independent pipe line companies, 35 leading oil companies, are using this easy, modern LIGHTNIN way to boost storage capacity, cut costs. How about you? For more facts, just call in your LIGHTNIN Mixer representative (he's listed in Composite Catalog). Or write us today.

Lightnin® Mixers

MIXCO fluid mixing specialists

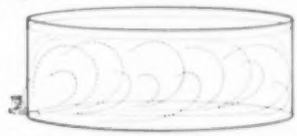
Get these helpful bulletins on BS&W control and LIGHTNIN Mixers. Check, tear out and mail to us today with your name and company address. Free—no obligation.

- ☐ BS&W Control with LIGHTNIN Mixers (B-503)
- ☐ Side entering mixers, 1 to 25 HP (B-104)
- ☐ Data sheet for figuring mixer requirements (B-107)
- ☐ Condensed catalog describing LIGHTNIN Mixers—all types (B-109)
- ☐ LIGHTNIN rotary mechanical seals for extra-low-cost mixing (B-111)

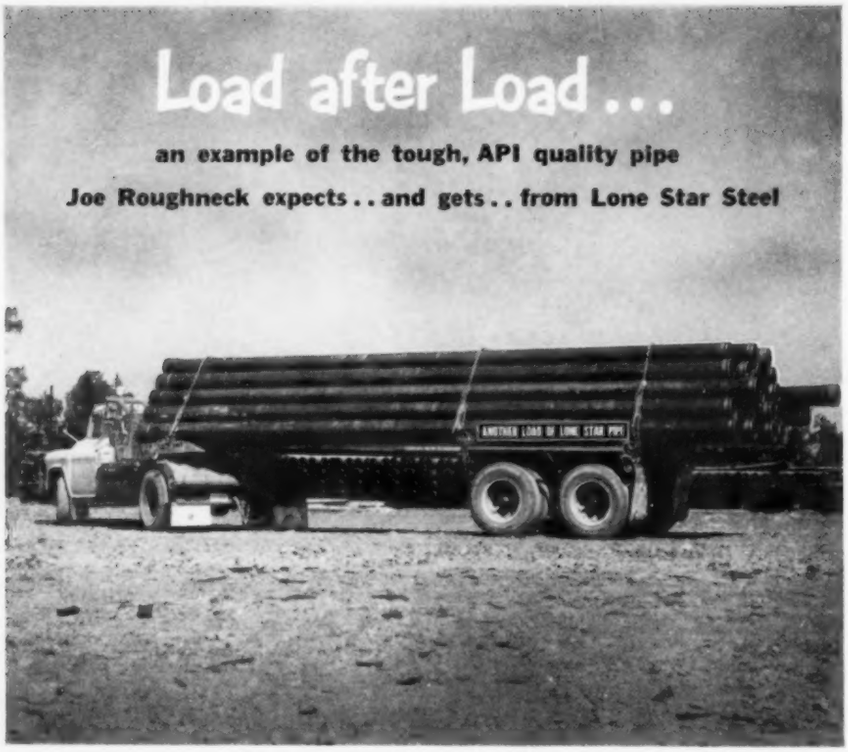
MIXING EQUIPMENT Co., Inc., 196-c **Mt. Read Blvd., Rochester 11, N.Y.**

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Avenue, Toronto 10, Ont.

DO YOUR TANKS LOOK LIKE THIS? Settled sludge is probably costing you much more than you realize. Cleaning cost is only part of the story.



...OR LIKE THIS? You actually save money when you keep tank bottoms clean this easy way. LIGHTNIN sediment control can save you as much as $1,000 per tank per year.



In the heart of the oil country, Lone Star Steel's huge plant is Joe Roughneck's solid source of supply for API casing, tubing and line pipe. Quality-controlled from mining of ore to finished pipe.. Lone Star electric weld pipe meets strict API specifications. Fully normalized, of course.

Crossing rivers, bending over hills and rugged terrain is routine for Lone Star line pipe.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

Lone Star STEEL COMPANY

EXECUTIVE—SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas
DISTRICT SALES OFFICES
912 Republic National Bank Building, Dallas, Texas
Houston, Texas | Midland, Texas | Tulsa, Oklahoma

sulator combines strength with long life and ease of installation.

The Model 57 insulator, designed to absorb load shocks and provide cathodic protection at pipe line crossings, is available in a size range of 2 to 36 inches. It is composed of glass fiber reinforced polyester and is compression molded at controlled high temperature and high pressure.

For more data, circle **No. E13** on Readers' Service Card, last page this issue.

Hydrocrane

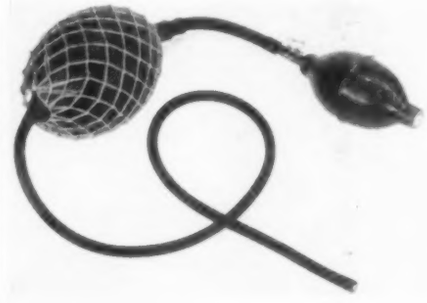
Bucyrus-Erie Co. has boosted the capacity of its H-5 Hydrocrane to 12 tons. Formerly rated at 10 tons, the H-5 is mounted on a low cost truck. Addition of a hydraulic circuit gives the H-5 a total of three independent circuits, and its hydraulic horsepower has been increased about one-third.

More powerful boom hoist, stronger outrigger boxes and high alloy steel in the hoist standards increase the hydrocrane capacity.

A new 12-volt electrical system is used in the H-5 to provide starts in all climates.

(This item supplements Bucyrus-Erie Co. data on Page 60 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E14** on Readers' Service Card, last page this issue.



Manometer

A manometer pressure bulb assembly for field testing of orifice meters, low pressure regulators and gages, liquid levels, and source of low pressure air is announced by W. H. Curtin & Co.

The manometer consists of a hand pressure bulb equipped with a small "bleeder valve," an expansion reservoir protected by a heavy silk net and connecting rubber tubing. By opening and closing the finger tip control needle valve, the operator can accurately control the reducing pressure.

For more data, circle **No. E15** on Readers' Service Card, last page this issue.

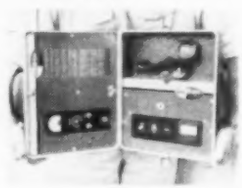
FISHER Leads Again!
New Transistorized Pipe Finder!

FIRST to build pipe finders;
FIRST to use Fiberglas cases;
FIRST to use single-turn, solid-metal loops—announces the world's newest transistorized pipe-cable finder.

Here's what exclusive Fisher transistorized design means to you:

- Greater depth penetration
- Pinpoint accuracy
- Extraordinary battery life—one year between battery changes
- Built-in battery testers
- 90% less maintenance costs
- No tubes

Only $220.00



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PIPE
VALVES
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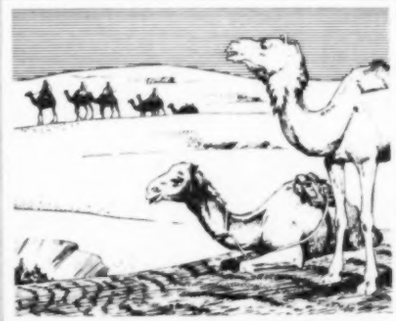
PIPE WRAP
INDUSTRIAL SUPPLIES

Houston, Dallas, Texas Denver, Colorado Ponca City, Okla.

PIPELINES
are in the NEWS



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OIL • GAS • WATER • PRODUCTS PUMPING STATIONS AND PIPELINES

Announcing Three Complete Locations to Serve You!

HOUSTON. Wayne A. Johnson, President, directs the company's activities from the Main Office in Houston. Mr. Johnson is well known in the cathodic protection profession and is the author of many technical articles in the field. P. O. Box 19177, Houston, Texas.

GREAT BEND, KANSAS. Harvey Fanshier, Mid-Western representative for Corrosion Rectifying Company is a graduate of Kansas State College with extensive experience in salt water disposal and corrosion prevention. Rt. 2, Great Bend, Kansas.

NEW ORLEANS, LA. James T. Condry, New Orleans representative, is a graduate Electrical Engineer in charge of evaluation, design, installation and materials sales for the Louisiana territory. He has wide experience in marine and offshore installations. 2322 Airline Highway, Kenner, Louisiana.

COMPLETE CORROSION PREVENTION
(Cathodic Protection)
SERVICE

CORROSION RECTIFYING CO., INC.
5310 Ashbrook Phone MO 7-6659
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no problem on a Sheehan spread!

. . . like a chameleon, SHEEHAN adapts to the environment.

Whether a spread is strung over flat farm lands or crowded into a congested city has little effect on SHEEHAN'S efficiency and speed of operation. With a versatile staff of qualified personnel and a wide selection of modern equipment, SHEEHAN can easily adjust to existing right-of-way conditions.

Whether your next line is laid *mile by mile* or *block by block*, it will be successful if it's built by SHEEHAN.

Let Sheehan's experience work for you on your next pipe line project.

SHEEHAN PIPE LINE CONSTRUCTION CO. TULSA OKLA.

SHEEHAN

NATIONAL BANK OF TULSA BUILDING

TULSA, OKLAHOMA

Power Loader

International Harvester Company has announced a new front mounted power loader for use on International 330,350 and 300 utility tractors.

Known as the McCormick U-34B power loader, it can be run either by hydraulic system or with a special large capacity front mounted hydraulic pump. A variety of interchangeable attachments adapts the loader to many loading, lifting grading and material moving jobs. A crane attachment and 7-foot leveling and grader blade can be used on the loader booms.

For more data, circle **No. E16** on Readers' Service Card, last page this issue.

Wind Driven Power

Automatic Power, Inc. announces a wind driven power package to provide electrical power in remote, isolated areas. Designed to operate on a fully automatic basis, it consists of a 6 kilowatt wind generator, battery bank and a Nordberg diesel stand-by generator. Installations are in use supplying power for radio relay stations, remote farms, small housing estates, islands, pumping plants for irrigation and draining and aids to navigation lights and fog signals.

The high efficiency blade design permits electrical power generation at wind velocities as low as 6 mph, while maximum continuous output of 6 kw is obtained at a wind velocity of 20 mph. The complete plant, mounted on a 33-foot steel tower, can withstand wind velocity in excess of 100 mph. During periods of low velocity, a bank of batteries carries the load, and the Nordberg generator automatically starts and recharges the battery.

(This item supplements Automatic Power, Inc. data on Pages 48-49 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E17** on Readers' Service Card, last page this issue.

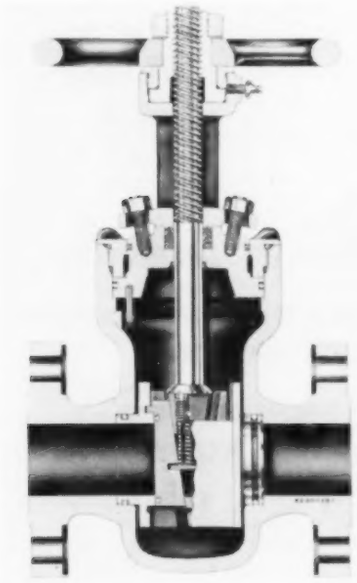
Hi-Electro

Caterpillar Tractor Company has developed hardened cutting edges to meet tougher job conditions. Obstacles such as rocks and boulders give scraper cutting edges a thorough pounding during ram-pack, push loading and high speed bowl braking. Bulldozers undergo equally severe treatment.

Caterpillar's Hi-Electro hardening obtains wearability and strength and the edge projected area is kept thin enough for good penetration.

(This item supplements Caterpillar Tractor Co. data on Pages 67-69 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E18** on Readers' Service Card, last page this issue.

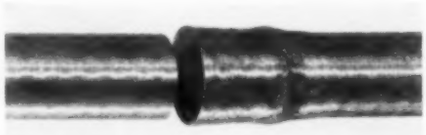


Keroseal Valve

Kerotest Manufacturing Company has developed a non-lubricated optional flow, double block and bleed full opening valve —Keroseal. Keroseal is designed to handle gases, petroleum products, petrochemical fluids and numerous other products. Its features are a new principle of operation which eliminates galling or wear at the seating surfaces; a vapor tight seal; design which permits servicing without having to remove the valve from the line; and minimum maintenance.

Provision has been made for installation of a bleed valve. Driven by a handwheel, gear or motor, it is operated by the raising or lowering of the threaded stem.

For more data, circle **No. E19** on Readers' Service Card, last page this issue.



Plastic Pipe

Amercoat Corporation announces a corrosion resistant, light weight plastic pipe. Manufactured in 2 to 12-inch range to meet ducting, tubing and piping needs of the pipe line, refining and process industries, the new pipe consists of interwoven fiberglass filaments, impregnated with epoxy resins and heat cured.

Known as Bondstrand, it comes in rigid 20-foot lengths with ends plain, bell-and-spigot or flanged. The nonflammable and crush resistant pipe may be used for petroleum products, oil, water, water disposal and most dilute acids and alkalis.

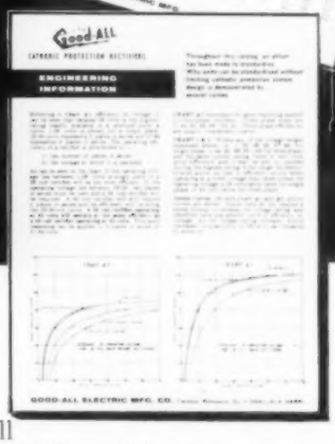
Two standard series are in production, one with a nominal pressure taking of 250 psi and another of 500 psi.

For more data, circle **No. E20** on Readers' Service Card, last page this issue.

Now . . . you can order from STANDARDIZED ratings to get MAXIMUM OUTPUT per DOLLAR

Good-ALL

CATHODIC PROTECTION RECTIFIERS



For the first time in the industry you can quickly select a rectifier to fit your requirements and be sure it will be the **most economical buy!** Good-All rectifier engineers have standardized rating tables in a carefully "stepped" progression, based on the ideal utilization of components, designs and case sizes. Why this can be done without limiting cathodic protection is explained in the new Good-All "Catalog-Manual."

The Good-All line is the QUALITY line

CUSTOM-AIR

Air cooled, lightweight and compact. Highly efficient. Individually designed stacks and transformers.

FEATURES: All contacts and terminals silver plated. Circuit breakers with instantaneous and time delay trips. 20 D-C output steps from zero to full rating. Rugged steel case with front, sides and top removable for easy access.

CUSTOM OIL

For extremely dusty, contaminated or humid areas.

FEATURES: New case design adds 10-15% greater cooling capacity. All components enclosed in case, with "easy to open" toggle-latch top. Oil creep problem eliminated. All "Custom" specifications.

ADD-A-STACK

Flexible design. Stacks may be quickly added or removed, wired in parallel, series, or series-parallel combinations to obtain great variety of outputs.

DESIGNED FOR: Single phase installations where ground bed resistance varies or current requirements can't be determined in advance, or installations where a change in requirements is anticipated.

TYPE-N

For **LOW COST** protection of Distribution Systems, wells, storage tanks, etc. A small, custom quality, oil immersed rectifier-at prices lower than an air cooled rectifier of equivalent rating.

FEATURES: Output easily adjusts with silver contact switch. Attractive steel case —grey Hammertone baked enamel finish.

See your nearest Representative for NEW CATALOG-MANUAL

(Write GOOD-ALL for Representative list)

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ELECTRICAL MECHANICAL DIV. 122 W. 1ST ST., OGALLALA, NEBRASKA

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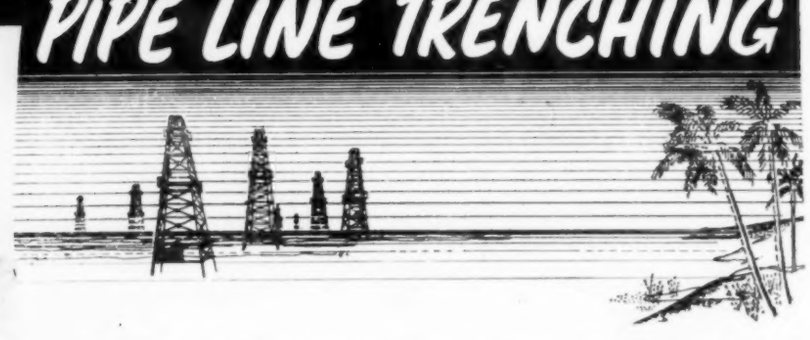
SHREVEPORT, LOUISIANA

PIPE LINE TRENCHING

16 60 Model Trencher digging in hard sand

in the **MIDDLE EAST**



Engineers in oil-producing countries know the best machines for the job. For trenching, they specify ALLEN—a name renowned for reliability, freedom from costly breakdowns, and ease of maintenance. In hot, dusty conditions, ALLEN trenchers slog on, day in, day out, standing up to years of continuous hard work—they have no equal anywhere.

Three models are available, the 12/21, the 16/60, and the new 14 30 for medium size trenches.

ALLEN TRENCHERS

Illustrated catalogues and technical data on request.

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New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Gooseneck Trailer

Rogers Brothers Corporation has released a four-page, illustrated brochure featuring Roger's 'hydra-lift' detachable gooseneck trailers. The brochure describes the foot mounted hydraulic ram which raises and lowers the gooseneck while resting upon the ground. The hydraulic ram permits lowering or raising of the trailer for loading and unloading, for changing tires, and to ease transportation difficulties such as railroads, low clearances, etc.

To get a copy, circle **No. E21** on Readers' Service Card, last page this issue.

Road Boring

A 16-page brochure has been published by the BorTunCo road boring and tunneling company. The illustrated booklet includes the history of the company and descriptions of its five divisions. BorTunCo does road boring for industrial and municipal utilities, and for all oil, gas and products pipe lines throughout the country.

To get a copy, circle **No. E22** on Readers' Service Card, last page this issue.

Expansion

Southwestern Industrial Electronics Company has issued a 32-page catalog on the company's operations, future plans and management. SIE is undergoing an expansion program with construction of new plants in Houston. The catalog includes sections on research, engineering, production, heavy manufacturing, field service and plant equipment.

To get a copy, circle **No. E23** on Readers' Service Card, last page this issue.

Tank Weighing

A new concept of tank weighing as a measurement of tank contents is described in a four-page brochure issued by The A. H. Emery Company.

Emery Hydraulic Load Cell, as a load sensing device in a weighing system, can provide indication, recording, printing or controlling of the contents of tanks in the processing industry.

To get a copy, circle **No. E24** on Readers' Service Card, last page this issue.

Moto-Crane

The Thew Shovel Company has released a eight-page catalog describing its new 35-ton Loarin Moto-Crane. The illustrated, two-color, publication describes several features of the high capacity, heavy duty lifting crane which is easily transportable over highways. A revolutionary "shear ball" mounting, which eliminates turntable rollers; a 35 foot pin-connected boom of alloy steel which gives increased lifting capacity; and a three position turntable mounting for maximum efficiency are a few of developments of the moto-crane.

To get a copy, circle **No. E25** on Readers' Service Card, last page this issue.

Spin Top

A new six-page illustrated bulletin covering spin top enclosures for magnetic starters and circuit breakers in hazardous locations is offered by Square D. Company.

A complete pictorial description of how to install the new weather-resisting enclosure is given in the two-color bulletin. It also shows forms and sizes available and lists pertinent features.

To get a copy, circle **No. E26** on Readers' Service Card, last page this issue.

Station Maintenance

How to speed cleaning at pumping stations is reported in Oakite Products, Inc., four-page service report on pumping station maintenance. The bulletin describes the use of Oakite Saturol, a di-phase solvent detergent which cleans diesel parts by immersion, without brushing or scrubbing. It tells how to remove oil and scale from lube oil collars by soaking in Oakite Compound 85. It also discusses maintenance cleaning, paint stripping and the cleaning of crude and natural gas lines.

To get a copy, circle **No. E27** on Readers' Service Card, last page this issue.

Koppers Brochure

Koppers Company, Inc. has published a 32-page brochure giving a brief description of the company, its products and activities.

Covering the history and development of the company, the brochure includes sketches of the Chemical, Engineering and Construction, Metal, Tar and Tar Products divisions of Koppers Company, Inc.

To get a copy, circle **No. E28** on Readers' Service Card, last page this issue.

Mobile Installations

How two horsepower can do the job of 160 hp. for keeping truck radio batteries charged is described and illustrated in a new mobile installations folder released by D. W. Onan & Sons, Inc.

The folder features sections covering the systems of battery charging with ac power, high battery charging output, and battery charging only.

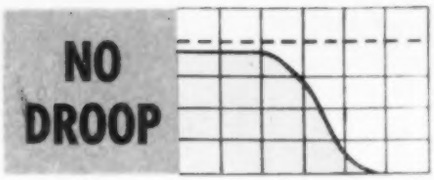
To get a copy, circle **No. E29** on Readers' Service Card, last page this issue.

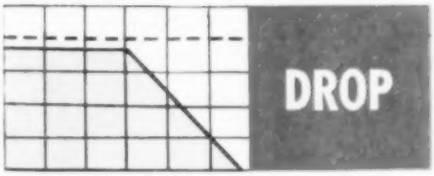
Joining Pipe

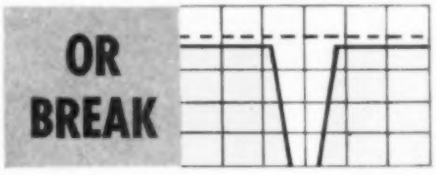
An illustrated bulletin offered by the Victaulic Company of America features the "Vic-Easy" method of joining thin wall steel and aluminum pipe and tubing and tells how the new method provides leak-tight connections by means of quick couplings assembled on grooves precision-rolled in the ends of the tubing.

The bulletin gives details of the system and lists applications for which the method is suitable.

To get a copy, circle **No. E30** on Readers' Service Card, last page this issue.







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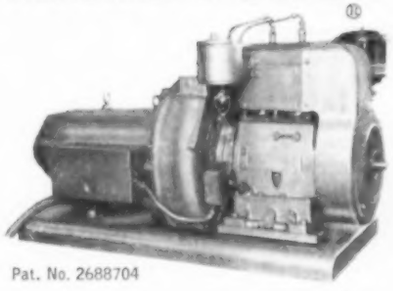
MICRO-POWER



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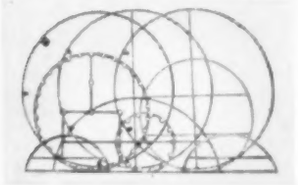

HEAT EXCHANGER GASKETS

Made in any size or shape needed in double jacket type. Also cut from solid metal or sheet packing. Write for Bulletin 564.

CORRUGATED METAL GASKETS

Plain or jacketed type. Made of ingot iron, aluminum, stainless steel, copper, brass, nickel and monel in all sizes and shapes. Write for Bulletin 565.

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pipeline contractors
Incorporated
•
Houston, Texas

Better, Stronger Piping Assemblies

through new Fluor cold-extruded prefabrication

Alloy steel header, with cold-extruded nozzles

Cold-extruded header, containing 45° miter weld

16-in. outlet nozzle, extruded in 30-in. diameter dampener head

Simple, more accurate fit-up... smoother nozzle contours... elimination of reinforcing pads assure important savings

WHEN YOU specify a multiple outlet header, cold-extruded by the new Fluor technique, you obtain a prefabricated piping assembly that offers higher strength, closer dimensional tolerance, smoother surface and greater uniformity.

Note these advantages Fluor-forming provides:

BETTER CONSTRUCTION: Fewer and simpler welds. More effective X-ray inspection.

LOWER MATERIAL COST: Elimination of reinforcing pads, saddles and collars makes savings in material costs substantial, especially where alloy steels are used.

SIMPLIFIED DESIGN: Nozzles or branches can be located anywhere along or around the header pipe.

SMOOTH NOZZLE CONTOURS: Minimizing pressure drop, reducing turbulence and erosion.

FASTER PRODUCTION: Less welding, less inspection make possible faster production and quicker delivery.

IMPROVED FIT-UP: Because of uniformly closer dimensional tolerances for each outlet nozzle, fit-up to adjoining piping is simple, accurate.

SAFETY: Uniform wall thickness, even distribution of mechanical stresses, avoidance of reinforcing pads and heavy welds assure protection against failure.

Write for Bulletin CE-0.001. EXTRUSION SALES, Fluor Products Company, Paola, Kansas.

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We're Guided By Service As Well As Performance

IN STANDARDIZING ON GASO PUMPS

Let's face it. It isn't pumps but *pumping service* that we buy when we place a pump order; and it's service that sold us on Gaso Pumps. Service that starts with intelligent recommendations by nearby distributors. Service that continues through years of dependable performance. And service that extends, in many cases, a quarter-century beyond the purchase date, with the immediate delivery of parts for long-obsolete standard models. Because of such service, Gaso became a habit with us...a habit we made official by specifying Gaso Pumps whenever the requirements fall within their capacity range.

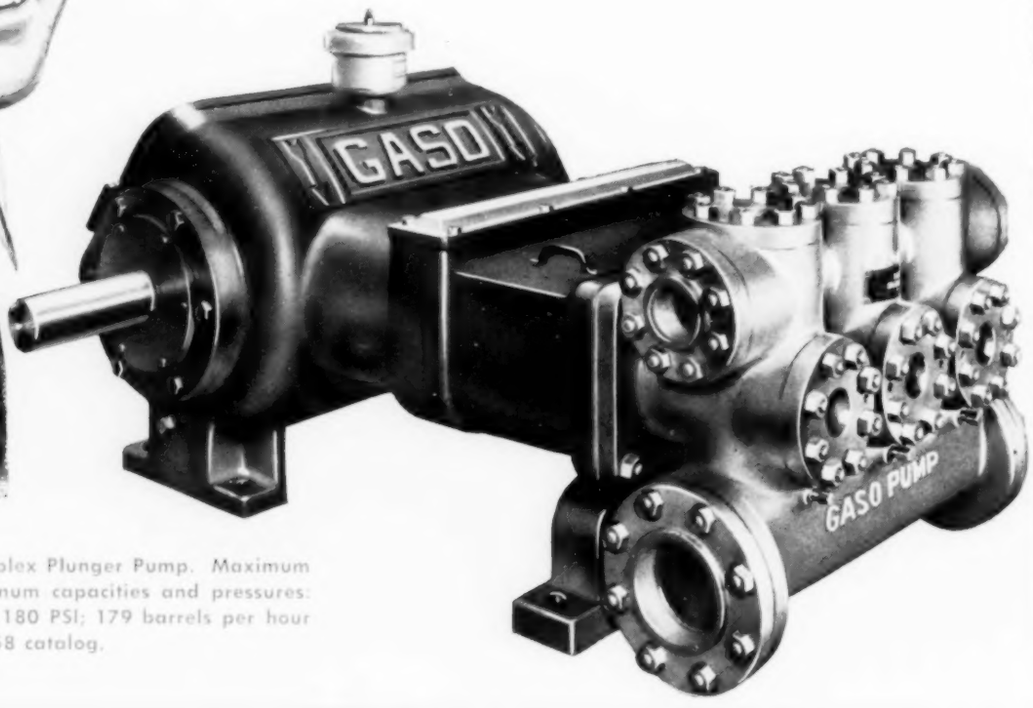

Fig. 3466 Horizontal Triplex Plunger Pump. Maximum speed, 250 RPM. Maximum capacities and pressures: 91 barrels per hour at 1180 PSI; 179 barrels per hour at 600 PSI. Write for 1958 catalog.

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